Galaxy 65 User Guide

Part No. 43061-02A

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Notices

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Preface

What is in this guide

This user guide gives you step-by-step instructions on how to install, configure and connect the Galaxy 65 storage Subsystem to your host computer system, and how to use and maintain the system.

Who should use this guide

This user guide assumes that you have a working knowledge of the Fibre Channel environment into which you are installing the Galaxy 65 system. If you do not have these skills, or are not confident with the instructions in this guide, do not proceed with the installation.

International Standards

The Galaxy 65 storage system complies with the requirements of the following agencies and standards:

- CE to IEC 950/EN60950
- UL 60950
- cUL

Potential for Radio Frequency Interference

USA Federal Communications Commission (FCC)

Note This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. The supplier is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user’s authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

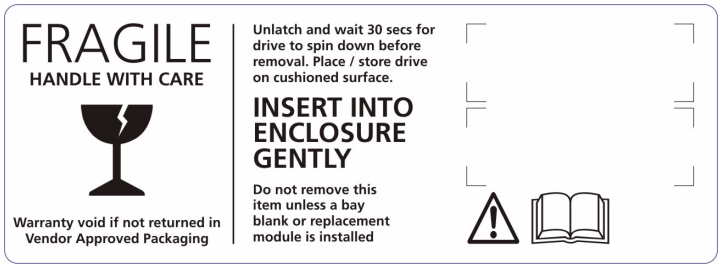
Note FCC approval only applies when using the supplied screened Ethernet cable.

European Regulations

This equipment complies with European Regulations EN 55022 Class A: Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipments and EN50082-1: Generic Immunity.

Safety

All plug-in modules are part of the fire enclosure and must only be removed when a replacement can be immediately added. The system must not be run without all units in place.


FRAGILE
HANDLE WITH CARE
Warranty void if not returned in Vendor Approved Packaging
Unlatch and wait 30 secs for drive to spin down before removal. Place / store drive on cushioned surface.
INSERT INTO ENCLOSURE GENTLY
Do not remove this item unless a bay blank or replacement module is installed

Drive Carrier Module Caution Label:

- Do not operate with modules missing
- Spin down time 30 seconds

Permanently unplug the unit if you think that it has become damaged in any way and before you move it.

- A Galaxy 65 enclosure can weigh up to 37kg (81lb). Do not try to lift it by yourself.

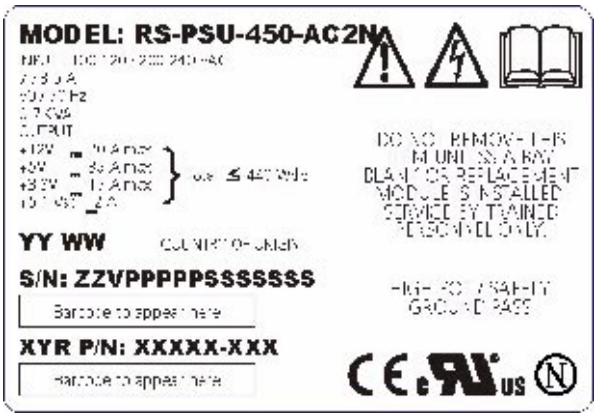
Chassis Warning Label:

Weight Hazard

- Do not attempt to lift the enclosure by means of the extended LRC module or by the handles on the PSU/Cooling module as they are not designed to support the weight of the populated enclosure.
- In order to comply with applicable safety, emission and thermal requirements no covers should be removed and all bays must be fitted with plug-in modules.

LRC Module Caution Label:

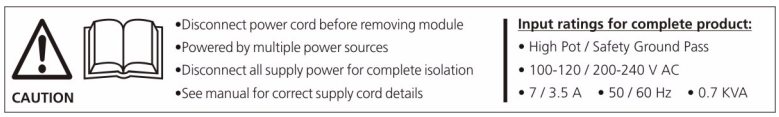
Do not operate with modules missing



PSU/Cooling Module Caution Label:

Do not operate with modules missing

- The Galaxy 65 unit must only be operated from a power supply input voltage range of 100 -120VAC or 200-240 VAC.
- The plug on the power supply cord is used as the main disconnect device. Ensure that the socket outlets are located near the equipment and are easily accessible.
- This equipment is intended to operate with two working PSUs.
- If powered by multiple AC sources, disconnect all supply power for complete isolation


CAUTION
•Disconnect power cord before removing module
•Powered by multiple power sources
•Disconnect all supply power for complete isolation
•See manual for correct supply cord details
Input ratings for complete product:
• High Pot / Safety Ground Pass
• 100-120 / 200-240 V AC
• 7 / 3.5 A • 50 / 60 Hz • 0.7 KVA

PSU Warning Label:

Power Hazards

- The power connection must always be disconnected prior to removal of the Power Supply/Cooling module from the enclosure.
- A safe electrical earth connection must be provided to the power cord. Check the grounding of the enclosure before applying power.

- Provide a suitable power source with electrical overload protection to meet the requirements laid down in the technical specification.
- A faulty power supply/cooling module must be replaced with a fully operational module within 24 hours.

Warning **Do not remove covers from the power supply unit. Danger of electric shock inside. Return the PSU to your supplier for repair.**

PSU Safety Label:

Electric Shock Hazard Inside

Caution *Caution: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

Battery Safety

The battery is user replaceable, please refer to the Battery Replacement Procedure.

Warning **There is a danger of explosion if the battery is incorrectly replaced.**

- Dispose of used batteries in accordance with the manufacturer's instructions and National regulations.

Laser Safety

Class 1 Laser Product

When the Galaxy 65 Subsystem is supplied with optical modules they contain a laser that complies with Laser Class 1, US 21 CFR (J) and EN 60825-1.

If optical modules are to be provided and fitted by the end user, lasers must comply with the standards listed above.

Rack System Precautions

The following safety requirements must be considered when the unit is mounted in a rack.

- The rack design should incorporate stabilizing features suitable to prevent the rack from tipping or being pushed over during installation or in normal use.
- When loading a rack with the units, fill the rack from the bottom up and empty from the top down.
- The rack should comply with the airflow requirements detailed in the technical specification.
- The rack design should take into consideration the maximum operating ambient temperature for the unit, which is 40°C when dual cooling modules are fitted.
- The rack should have a safe electrical distribution system. it must provide overcurrent protection for the unit and must not be overloaded by the total number of units installed in the rack. Consideration of the electrical power consumption rating shown on the nameplate should be used when addressing these concerns.
- The electrical distribution system must provide a reliable earth for each unit and the rack.
- Each power supply in each unit has an earth leakage current of 0.65mA. The design of the electrical distribution system must take into consideration the total earth leakage current from all the power supplies in all the units. The rack will require labelling with "HIGH LEAKAGE CURRENT. Earth connection essential before connecting supply".
- The rack when configured with the units must meet the safety requirements of UL1950 and IEC 60950.

ESD Precautions

Caution *It is recommended that you fit and check a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling Galaxy 65 plug-in modules and components. Avoid contact with backplane components and module connectors, etc.*

Data Security

- Power down your host computer and all attached peripheral devices before beginning installation.
- Each enclosure contains up to 16 removable disk drive modules. Disk units are fragile. Handle them with care, and keep them away from strong magnetic fields.
- *All* the supplied plug-in modules and blanking plates must be in place for the air to flow correctly around the enclosure and also to complete the internal circuitry.
- If the Subsystem is used with modules or blanking plates missing for more than a few minutes, the enclosure can overheat, causing power failure and data loss. Such use may also invalidate the warranty.
- If you remove any drive module, you may lose data.
  - If you remove a drive module, replace it immediately. If it is faulty, replace it with a drive module of the same type and capacity
- Ensure that all disk drives are removed from the enclosure before attempting to manhandle or move the rack installation.
- Do not abandon your backup routines. No system is completely foolproof.

Special Tools and Equipment

There are no special tools required but in order to complete the assembly of some configurations you may need the following (not supplied):

- Security keys (one of these should be included with your Galaxy 65 enclosure for use with the drive locks).

Related Documentation

- Galaxy 65 Getting Started Manual (P/N 44521-01A), Issue 1.0
- Galaxy 65 Quick Installation Guide (P/N 43062-01A), Issue 1.0
- Galaxy 65 Series Rack Installation Guide (P/N 43638-01A), Issue 1.0

Conventions

This Getting Started guide uses several conventions to help explain how to use the X24.

Convention	Definition
Bold	Words in **bold** indicate items to select such as menu items or command buttons.
CTRL-R	Keys you press simultaneously. In this example, hold down the **Ctrl** key and press the **r** key.
MB	The abbreviation MB is used for megabytes in all situations. However, the amount of data represented by MB differs as follows: For disk drives, arrays, partitions, and data rate statistics, 1 MB equals 1,000,000 using the International System of Units (SI) standard. For memory, 1 MB equals 1,048,576 using the memory industry standard.
Note	**Notes** give you information that can help you improve the performance of your system.
Important	**Important** gives you important information that may affect how you decide to set up your system.
Caution	*Cautions warn you about actions that may permanently delete data or cause damage to your system.*
Warning	**Warnings warn you about actions that may be hazardous to personnel, resulting in injury or death**

Revision History

Version	Date	Description of Change
Issue 1.0	June, 2003	Initial (Beta) Release
Issue 2.0	January, 2004	**Chapter 1, Page 14** *amended:* **Section 1.6.10:** “(planned)” *deleted*.

Chapter 1

Introduction

1.1 The Galaxy 65 System

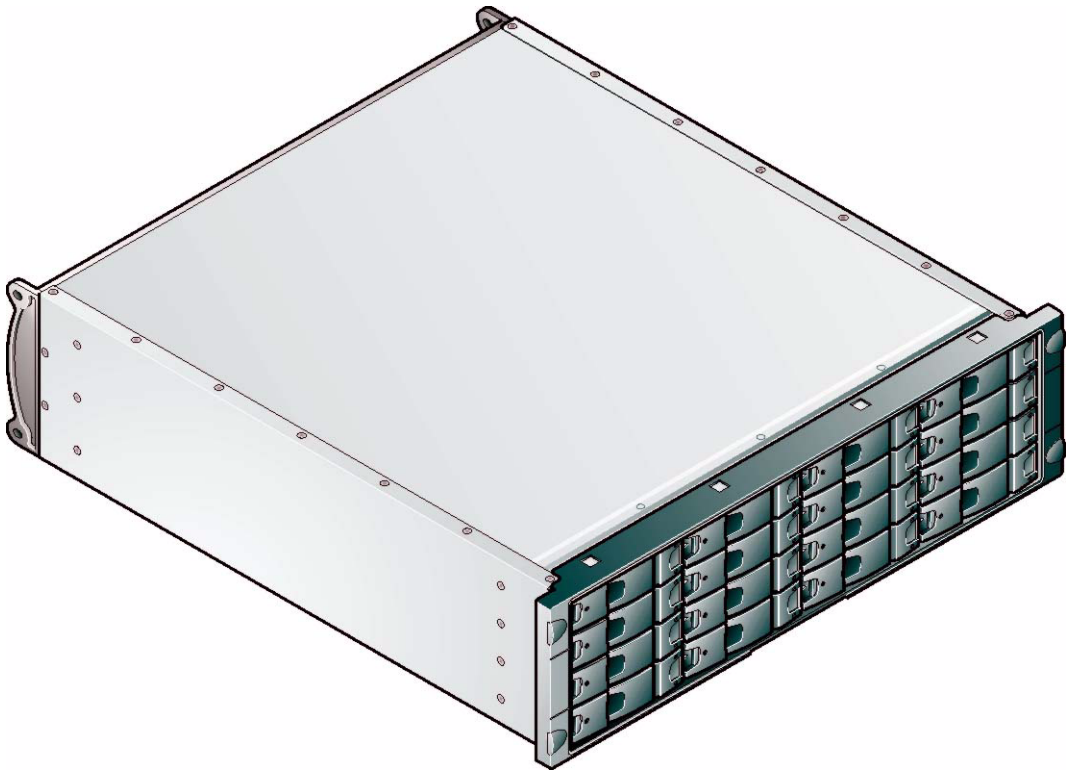


Figure 1–1 The Galaxy 65 (FC-AL) System

1.2 The Enclosure Core Product

The Galaxy 65 design concept is based on a Subsystem together with a set of plug-in modules. The Galaxy 65 Subsystem as supplied comprises:

- Chassis and Backplane with integral Operators Panel.
- Power Supply/Cooling plug-in modules, auto-ranging, 475W, AC (see Figure 1–5)
- FC-AL Drive Carrier Modules and associated dummy carrier modules (See Figure 1–10).
- FC-AL LRC 2Gb/s Input/Output Modules with integrated Rorke Data Galaxy 65 RAID controllers, known as Storage Managers.(See Figure 1–8).

1.2.1 Enclosure Chassis

The chassis consists of a sheet metal enclosure assembly containing a Backplane PCB and module runner system. This chassis assembly also includes an integral Operators (Ops) Panel mounted at the rear.

The chassis assembly contains 16 drive bays at the front, each of which accommodates a plug-in drive carrier module. The 16 drive bays are arranged in 4 rows of 4 drives. At the rear, the chassis assembly contains 5 module bays to house two Power Supply/Cooling modules, two LRC I/O modules and the integral Ops panel.

The Backplane PCB provides logic level signal and low voltage power distribution paths. Figure 1–2 and Figure 1–3 show front and rear views of an Galaxy 65 chassis respectively.

The 4 x 4 chassis is fitted with 19 inch Rack mounting features which enables it to be fitted to standard 19 inch racks and uses 3EIA units of rack space.

- A Bay is defined as the space required to house a single 1.0" high 3.5 inch disk drive in its carrier module. e.g. a 1 x 4 bay module would take the space of 1 drive width by 4 drive bays high (in rack mount configuration).

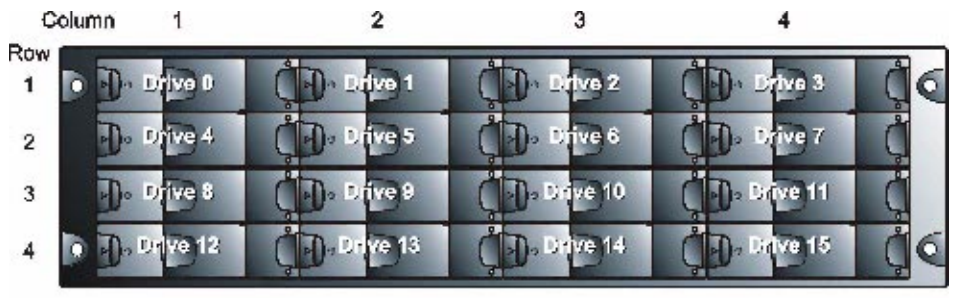


Figure 1–2 Galaxy 65 Enclosure Chassis (Front)

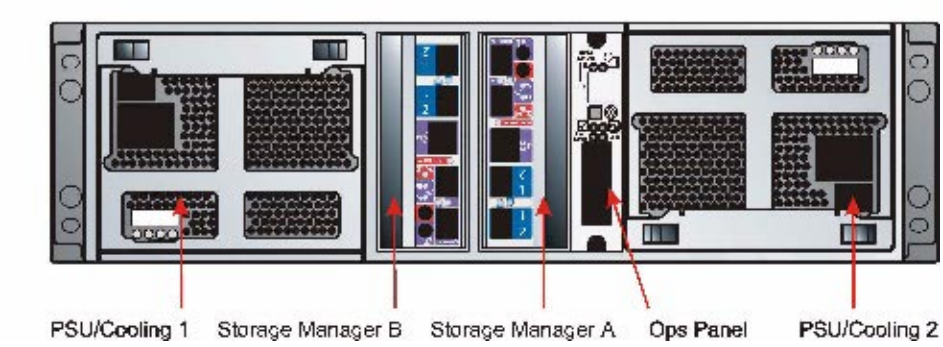


Figure 1–3 Galaxy 65 Enclosure Chassis (Rear)

1.2.2 Tower Option

An optional tower kit is available, which can be fitted to the rack chassis described here.

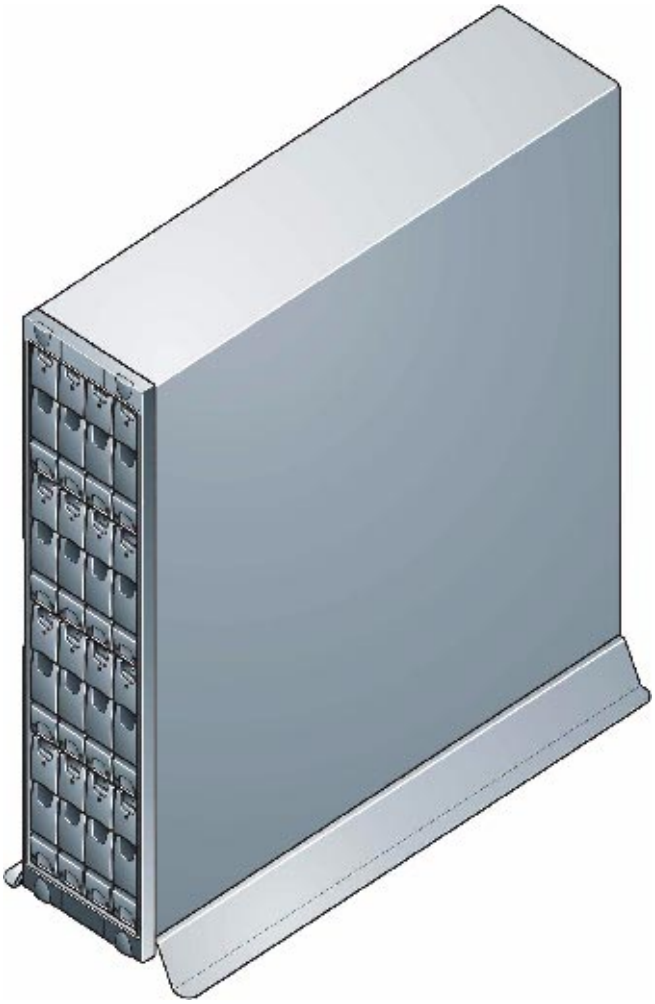


Figure 1–4 Galaxy 65 Tower Option

1.3 The Plug-in Modules

A Galaxy 65 Enclosure requires one or more of the following modules for normal operation:

1.3.1 Power Supply/Cooling Module

Two Power Supply/Cooling modules (Figure 1–5) are supplied mounted in the rear of the enclosure as part of the Subsystem core product.

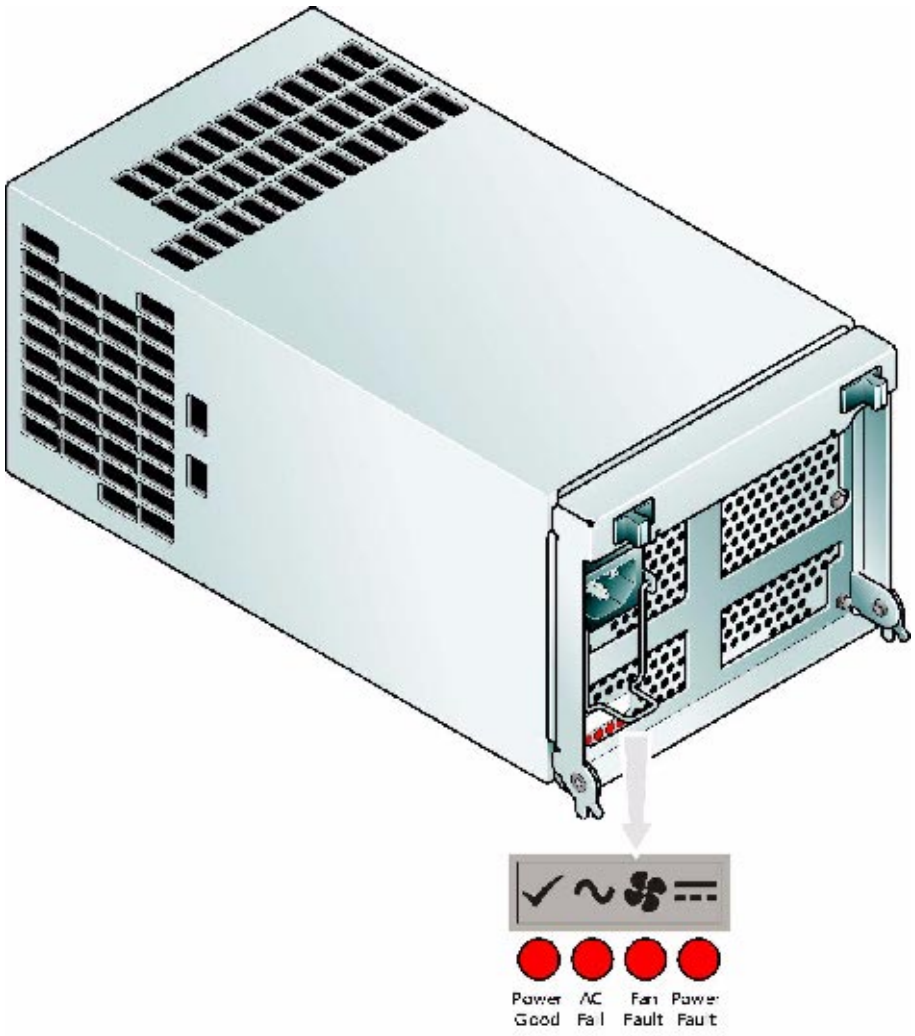


Figure 1–5 AC Power Supply/Cooling Module

PSU voltage operating ranges are nominally 115V or 230V AC, selected automatically.

Four LEDs mounted on the front panel of the Power Supply/Cooling Module indicate the status of the PSU and the fans.

Warning **The Power Supply/Cooling module is not an operator removable part. It should only be removed by a technician who has knowledge of the hazards present within the module.**

1.3.1.1 Multiple Power Supply/Cooling Modules

The Galaxy 65 system must always be operated with two Power Supply/Cooling modules fitted. The two Power Supply/Cooling modules operate together so that if one fails the other maintains the power supply and cooling while you replace the faulty unit.

Module replacement should only take a few minutes to perform but must be completed within 5 minutes from removal of the failed module.

1.3.2 Operators Panel

Supplied as an integral part of the Enclosure core product, a typical Operators (Ops) Panel is shown in Figure 1–6.

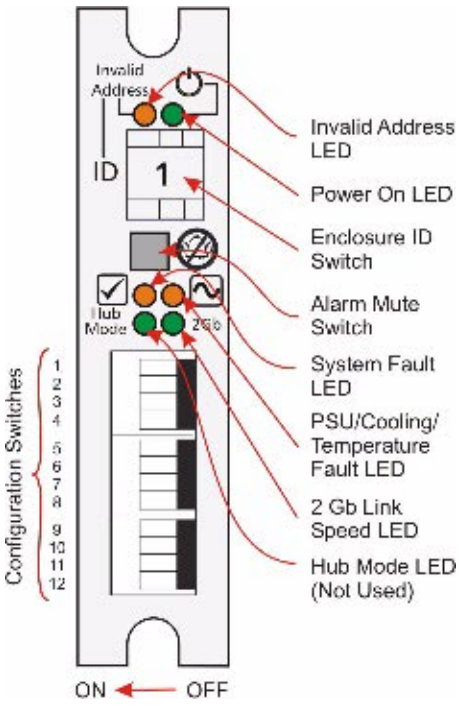


Figure 1–6 Operators (Ops) Panel

The Ops Panel provides the enclosure with a micro controller which is used to monitor and control all elements of the Enclosure.

1.3.2.1 Ops Panel Indicators and Switches

The Ops Panel includes Light Emitting Diodes (LEDs) which show the status for all modules, an Audible Alarm which indicates when a fault state is present, a push-button Alarm Mute switch and a thumb wheel SEL_ID address Range selector switch.

The Ops Panel switch functions are shown in Table 1–1.

Important **Switch settings are only read at Power On.**

The Galaxy 65 enclosure ID must always be set to select ID1.

Table 1–1 Ops Panel Switch Functions *(Default settings for Galaxy 65 LRC usage at 2Gb/s)*

Switch Number	Function	Recommended Setting		Definition
1	Loop Select, Dual (2x8)	Off		LRC operates on two loops of 8 drives Mandatory
2	Not Used	Note: on Galaxy 65-FC2 enclosures this must be set On.		
3	Not Used			
4	Not Used			
5 & 6	Not Used			
7 & 8	Drive Loop Speed Select	*Sw7*	*Sw8*	
		On	Off	Force 2Gb/s
		Off	Off	Force 1Gb/s
9 & 10	Drive Addressing Mode Selection	*Sw9*	*Sw10*	
		On	Off	Mode 2, 2x8 mode. Mandatory
11	SOFT SELECT	On		Select Functions using the hardware switches
12	Not Used			

Caution *All mandatory settings must be observed in order for the Galaxy 65 system to function correctly.*

Note To set Host 1Gb use the Ethernet connected configurator.

1.3.3 Loop Resiliency Circuit Input/Output Module (FC-AL)

The Galaxy 65 storage Subsystem includes an enclosure with rear facing bays which house two Loop Resiliency Circuit (LRC) I/O modules with integrated Rorke Data Galaxy 65 RAID controller, known as Storage Managers (SM) modules. (see Figure 1–3)

The FC-AL Backplane incorporates two independent loops formed by Port Bypass Circuits within the LRC I/O modules.

The plug-in SM modules have been designed for integration into a Galaxy 65 storage Subsystem, utilizing FCAL interfacing with the host computer system.

Processors housed on the LRC modules provide enclosure management and interface to devices on the Backplane, PSU, LRC and Ops Panel, to monitor internal functions. These processors operate in a master slave configuration to allow failover.

The module incorporates the following LED indicators, shown in Figure 1–7:

- Host Port 0 Signal Good (Green)
- Host Port 1 Signal Good (Green)
- Expansion Port 0 Rx Good (Green)

- Expansion Port 1 Rx Good (Green)
- ESI/LRC module fault LED (Amber)
- Cache Active (Green)
- RAID Controller Activity
  - Ready (Green)
  - Host Activity of either host channels (Flash off)
- Battery Fault (Amber)

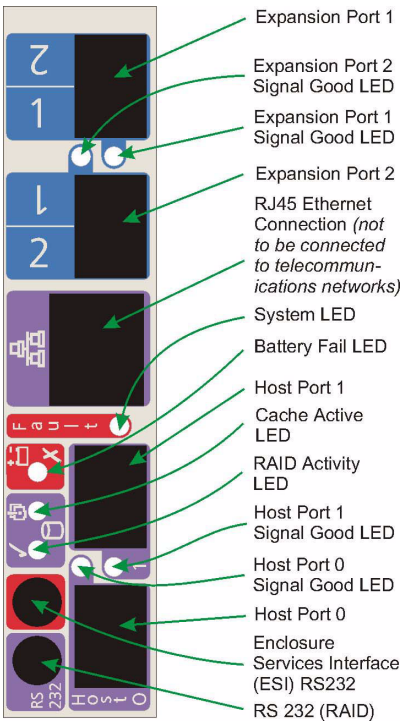

Expansion Port 1
Expansion Port 2 Signal Good LED
Expansion Port 1 Signal Good LED
Expansion Port 2
RJ45 Ethernet Connection (not to be connected to telecommun-ications networks)
System LED
Battery Fail LED
Host Port 1
Cache Active LED
RAID Activity LED
Host Port 1 Signal Good LED
Host Port 0 Signal Good LED
Host Port 0
Enclosure Services Interface (ESI) RS232
RS 232 (RAID)

Figure 1–7 LRC Panel Layout

Important **Fitting of a RAID controller to the LRC module is a factory only operation.**

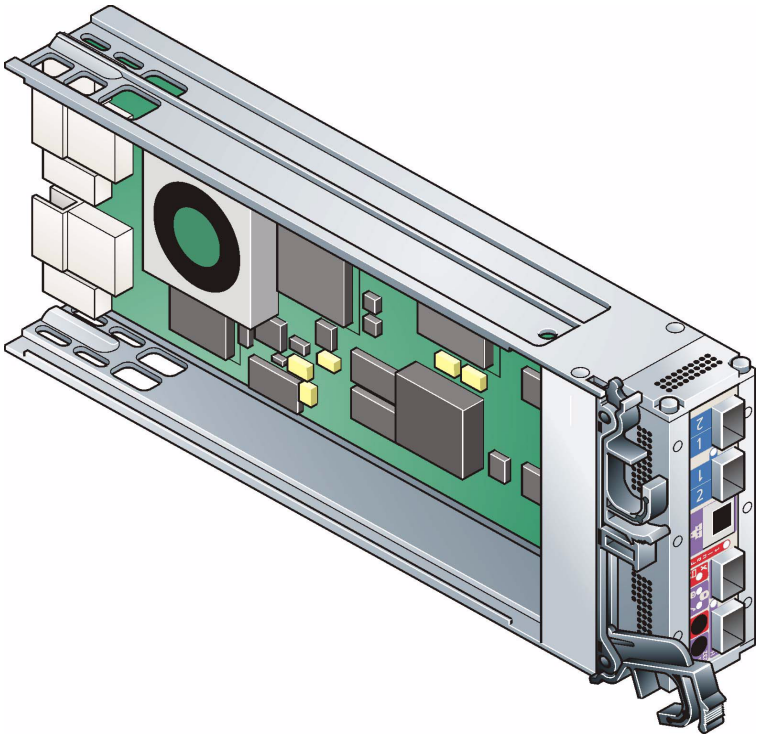


Figure 1–8 Galaxy 65 LRC (Storage Manager) I/O Module

Warning **Do not attempt to lift the enclosure by means of the extended SM module**

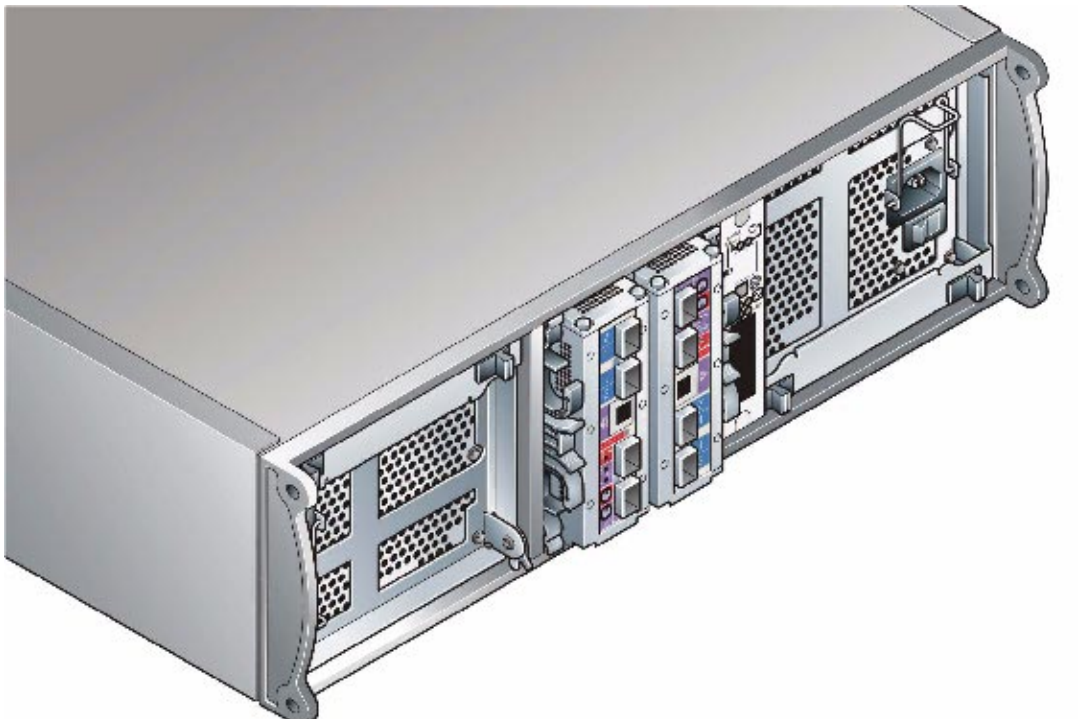


Figure 1–9 Galaxy 65 Enclosure with Storage Manager Modules and PSUs Installed

The Storage Manager module operates at 1 or 2 Gb.

- Two external ports for expansion to further enclosures are provided by SFP connectors
- Two external ports to the host controllers are provided from SM module all Form Factor (SFP) GBIC modules, auto-bypass at the output ports is provided.
- An RJ45 10/100 Base T Ethernet controller management port is provided on the LRC board, interfacing to the controller through 2 RS232 serial and GPIO lines.

Caution *The RJ45 Ethernet connector on the LRC module must not be connected to telecommunications networks.*

- The SM module also incorporates a standby Li-ion battery pack, 72 hours cache hold up time (512Mb). The battery cell has thermal protection and is connected to the RAID controller by flying lead.

Note The Galaxy 65 product range is available in 1Gb, 2Gb, JBOD or RAID variants, by changing the LRC modules. Please contact your supplier for details.

1.3.4 Drive Carrier Module

The Drive Carrier module comprises a hard disk mounted in a carrier. Each drive bay will house a single 1.0 inch high, 3.5 inch disk drive in its carrier.

Each disk drive is enclosed in a die-cast aluminum carrier which provides excellent thermal conduction, radio frequency and electro-magnetic induction protection and affords the drive maximum physical protection.

The front cap also supports an ergonomic handle which provides the following functions:

- Camming of carrier into and out of drive bays.
- Positive 'spring loading' of the drive/backplane connector.
- An anti-tamper lock operated by a torx socket type key.

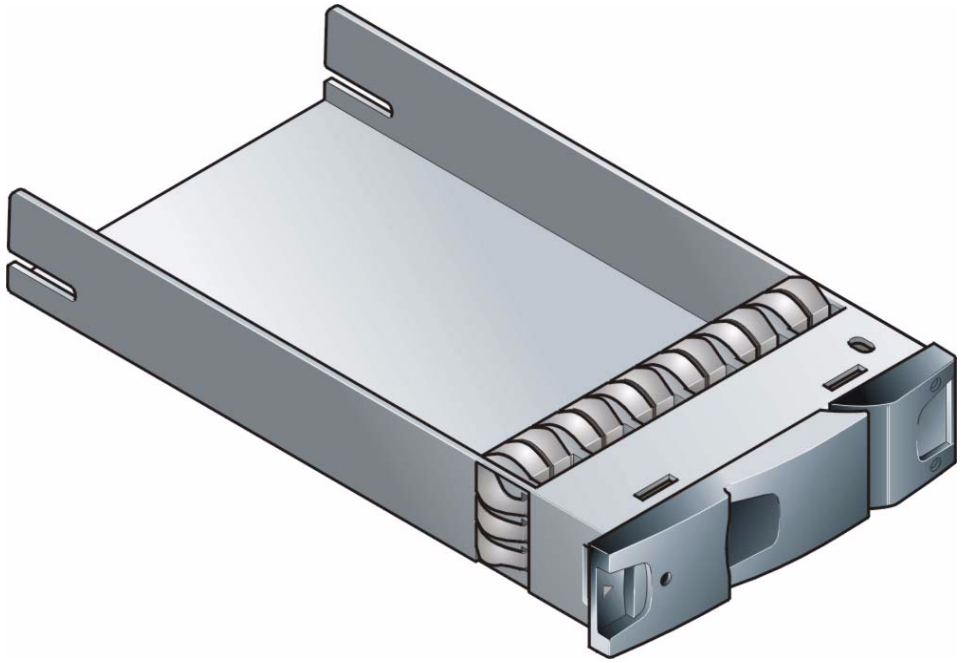


Figure 1–10 Drive Carrier Module

1.3.4.1 Drive Status Indicators

Each drive carrier incorporates two indicators, an upper (Green) and lower (Amber). In normal operation the green indicator will be ON and will flicker as the drive operates.

1.3.4.2 Anti-tamper Locks

Anti-tamper locks are fitted in the drive carrier handles (Figure 1–11) and are provided to disable the normal ‘pinch' latch action of the carrier handle.

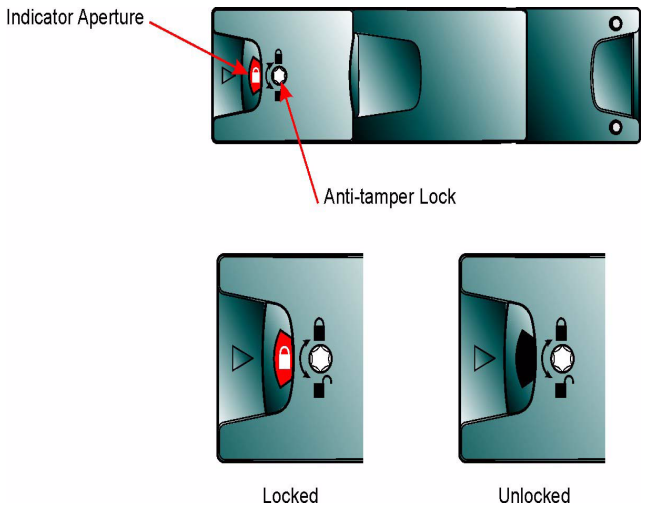


Figure 1–11 Anti-tamper Lock

1.3.5 Dummy Carrier Modules

Dummy carrier modules are provided for fitting in all unused drive bays. They are designed as integral drive module front caps with handles and must be fitted to all unused drive bays to maintain a balanced airflow.

Warning **Operation of the Enclosure with *ANY* modules missing will disrupt the airflow and the drives will not receive sufficient cooling. It is *ESSENTIAL* that all apertures are filled before operating the unit. Dummy Carriers are available for this purpose.**

1.4 Visible and Audible Alarms

The functional modules have associated status LEDs. The Ops Panel shows a consolidated status for all modules.

LEDs show constant green for good or positive indication. Constant Amber LEDs indicate there is a fault present within that module.

The Ops Panel also incorporates an Audible Alarm to indicate when a fault state is present and also an Alarm Mute push-button.

Warning **The Ops Panel is an integral part of the enclosure chassis assembly and can only be replaced by trained personnel.**

1.5 Installing your Galaxy 65 Subsystem

Please refer to the Galaxy 65 Getting Started Manual (P/N 44521-01A) for information on how to install your Galaxy 65 Enclosure and plug-in modules into an industry standard 19 inch rack cabinet.

1.6 Galaxy 65 Technical Specification

1.6.1 Dimensions

Rack Enclosure
Height 134mm, Width 446mm, Depth 511mm

Tower Enclosure
Height 501mm, Width 230mm *(including mounting feet*), Depth 511mm

Note It is recommended that a rack with a depth of no less than 700mm is used with this product.

1.6.2 Weight

Maximum Configuration	Rack mount:	37kg (81lb)
	Tower:	40kg (88lb)
Empty Enclosure (Rack)		9kg (19.8lb)
PSU/Cooling Module		4kg (8.8lb)
LRC I/O Module		1.5kg (3.11lb.)
Tower Conversion Kit		3kg (6.6lb)

1.6.3 AC Power (450W PSU)

Voltage Range	100-120 / 200-240 VAC Rated
Voltage Range Selection	Automatic
Frequency	50/60 Hz
Inrush Current	50A @ 260VAC
Power Factor	>0.98
Harmonics	Meets EN61000-3-2

1.6.4 PSU Safety and EMC Compliance

Safety Compliance	
	UL 60950
	IEC 60950
	EN 60950
EMC Compliance	CFR47 Part 15B Class A
	EN55022
	EN55024

1.6.5 Power Cord

(minimum requirements)

Cord Type	SV 0r SVT, 18 AWG minimum, 3 conductor
Plug	250V, 10A
Socket	IEC 320 C-14, 250V, 15A

1.6.6 Environment

Table 1–2 Ambient Temperature and Humidity

	Temperature Range	Relative Humidity	Max. Wet Bulb
Operational	5°C to 40°C	20% to 80% non-condensing	23°C
Non-Operational	0°C to +50°C	8% to 80% non-condensing	27°C
Storage	1°C to +60°C	8% to 80% non-condensing	29°C
Shipping	-40°C to +60°C	5% to 100% non-precipitating	29°C

Altitude, Operational	0 to 3047 m (0 to 10,000ft)
Altitude, Non-Operational	-305 to 12,192m (-1000 to 40,000ft)
Shock, Operational	Vertical axis 5g peak 1/2 sine, 10ms
Shock, Non-Operational	30g 10ms 1/2 sine
Vibration, Operational	0.21grms 5-500 Hz Random
Vibration, Non-Operational	1.04grms 2-200 Hz Random
Vibration, Relocation	0.3g 2-200 Hz sine

Acoustics	Less than 6.0 B LwA - operating at 20°C
Orientation & Mounting	19" Rack mount (3EIA Units)
• Rack Rails	To fit 800mm depth Racks compliant with IEC 297
• Rack Characteristics	Back pressure not exceeding 5 pascals (0.5mm water gauge)
Safety & Approvals	CE, UL, cUL
• EMC	EN55022 (CISPR - A), FCC A

1.6.7 Interfaces

Drive support	See drive carrier specification	
Attachment	• 1 FC-Galaxy 65 quad loop of 8 drives	
	Passive Backplane with 2 Loop Resiliency Circuit (LRC) I/O Module.	
	SFP HSSDC-2 cables	Maximum external cable length: 10m
	SFP optical cables	Maximum daisy chain cable length: see *SFP manufacturer's specification.*
Expansion	SFP	Cable length: as above

1.6.8 Drive Carrier Module Specification

Please contact your supplier for details of approved drives.

Important **Operating the Galaxy 65 Subsystem with non-approved drives may invalidate the warranty.**

Module Dimensions	Height 29.1mm Width 106.55mm Depth 207mm
Weight	0.88kg (1.0" 36Gb drive)
Operating Temperature	5° C to 40° C (when installed in an Galaxy 65 system enclosure with dual Power Supply/Cooling Modules)
Power Dissipation	18.7 Watts maximum

1.6.9 Galaxy 65 FC-AL LRC I/O Module Specification

LRC-Galaxy 65 Speed 2Gb
- Creates connections to 2 x 8 drive mode dual loop structures
- 2 external Expansion ports, SFP connectors
- 2 Host SFP ports
- 1 Ethernet port

Mounting Rear, single bays 3 and/or 4 *(see Figure 1–3)*

Connectors
- 2 x SFP module LC optical, max. cable length 500m, or,
- 2 x Copper HSSDC-2 connector, max. cable length 6m.
- 1 x RJ42 Ethernet connector
- 1 x RS232, 6 pin Mini-DIN *(factory use only)*

Battery Backup Li-ion Battery, Hold up time for RAID cache:
  - 512Mb: 72 hours (worse case)

LED Functions

• Host Port 0 Signal Good	Green
• Host Port 1 Signal Good	Green
• Expansion Port 0 Rx Good	Green
• Expansion Port 1 Rx Good	Green
• ESI/LRC module fault LED	Amber
• Cache Active	Green
• RAID Controller Ready	Green
• Battery Fault	Amber

Power Dissipation 5A @ 3.3V
7.4A @ 5V

1.6.10 RAID Card

RAID	Integrated Fibre - Fibre controller
	600k Hrs MTBF
LRC & ESI Function	1.2 MHz
Memory	512Mb - 1Gb

1.6.11 Software Enclosure Services (SES) Support

The enclosure has a sophisticated self-monitoring and reporting function which conforms to ANSI SES specifications.This reports on such topics as:
- Enclosure temperature
- Fan speed
- Drive condition
- Operator panel status
- RAID controller status: Not Ready, Partner Fail and Partner Present outputs

For more information on the implementation of this function please request a copy of the SES specification from your supplier.

Chapter 2

Operation

2.1 Before You Begin

Before powering up your Galaxy 65 enclosure please ensure that all the modules are firmly seated in their correct bays.

2.2 Power On

Do not operate the Subsystem until the ambient temperature is within the specified operating range. If the drives have been recently installed ensure they have had time to acclimatize before operating them.

Note Please refer to Section 2.3 for details of the Ops Panel LEDs and related fault conditions.

Follow the procedure below to power up the enclosure.

1 Apply AC Mains power to the enclosure. Turn the Power Supply/Cooling modules to ON.

2 On the Ops Panel, the Audible Alarm beeps once, all LEDs flash for 7 seconds then the Alarm double beeps.

3 All LEDs on the Ops Panel should be lit (Green) when the enclosure power is activated (and the disk drive motors should start).

Note All LEDs on the Ops Panel should be lit Green at power up to indicate that the system is functioning correctly. If any show Amber then a problem exists and the procedure in Chapter 4 , ”System Status”, on page 33 should be followed.

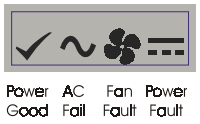
Important **If mains power is lost for any reason, on restoration of power the enclosure will re-start automatically.**

2.2.1 Power Supply/Cooling Module LEDs

The Power Supply/Cooling module incorporates 4 LEDs, located below the On/Off switch and shown in Table 2–1.

- Under Normal conditions the LEDs should all be illuminated constant GREEN
- If a problem is detected the color of the relevant LED will change to AMBER.

Table 2–1 PSU LEDs



PSU Good	Green
AC input Fail	Amber
Fan Fault	Amber
DC Output Fail	Amber

2.3 Ops Panel LEDs

The Ops Panel LEDs fault and status conditions are defined in Table 2–2 and shown in Figure 2–1.

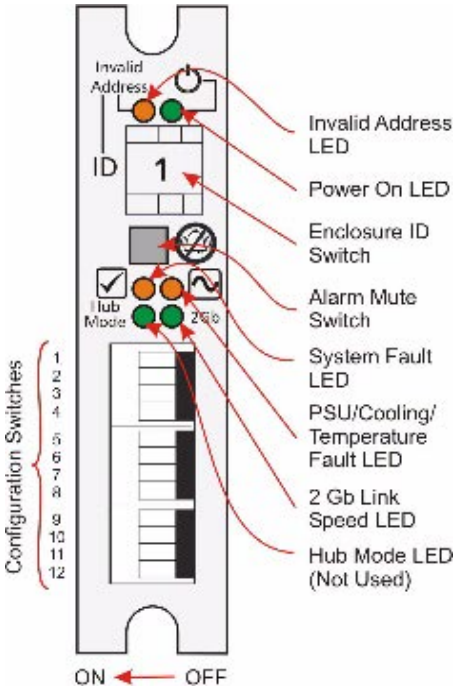


Figure 2–1 Ops Panel LEDs and Switches

Table 2–2 Ops Panel LED States

Ops Panel LEDs					Other Associated LEDs or Alarm	State Description
Power (Green)	**PSU/ Cooling/ Temp (Amber)**	**System (Amber)**	**Address Mode Error (Amber)**	**FC-Galaxy 65 Loop Speed**		
On	Off	Off	Off	Off		5V Aux present, overall power failed
On	***On***	***On***	***On***	***On***	single beep, then double beep	Ops Panel power On (5s) test state
On	Off	Off	Off			Power On, all functions good
On	***On***	Off			***PSU LEDs or Fan LEDs***	Any PSU fault or Fan fault
On	***On***	***Flash***				Over or Under temperature
On	Off	***On***			***ESI LED on LRC***	ESI processor A Failed
On	Off	***On***			***ESI LED on LRC***	ESI processor B Failed
On	Off	***On***			None	• Unknown (invalid or mixed) LRC module type installed, or • I2C Bus Failure (inter ESI processor), or • Backplane autostart watchdog failed.
On	***Flashing***	***Flashing***			PSU Removed	PSU removed and System power redundancy check option set. No indication if option not set.
On	Off	***Flashing***				No SES Drives fitted
On	***Flashing***	***On***			Intermittent audible alarm	Ops to ESI Communications failed
On			***Flashing***			Invalid address mode setting (change thumb wheel to valid ranges)
On				***On***		2Gb FC-Galaxy 65 Drive loop speed selected
On						RAID ONLY Host side

Please refer to Chapter 7, ”Troubleshooting and Problem Solving”, on page 59 for details of any fault indication.

2.4 Starting the Drives

All drives in the enclosure should automatically start their motors. If this has not occurred there may be a power problem (an alarm and power fault indication would normally be active). if there is only one Power Supply/Cooling Module present, the drive motors will spin up in a delayed sequence.

2.4.1 Disk Drives LEDs

Each drive carrier incorporates two indicators, an upper (GREEN) and lower (AMBER). In normal operation the Green LED will be ON and will flicker as the drive operates.

2.5 Power Up/Down

Power Up
Ensure all JBOD enclosures are powered up prior to powering on the Galaxy 65 enclosure.

Power Down
Ensure the Galaxy 65 enclosure is powered down prior to powering down the JBOD enclosures.

To power the Enclosure down,
either

- Switch off the Power Supply/Cooling modules installed in the Enclosure.

or

- Remove AC Mains at the power source

Chapter 3

Galaxy 65 RAID Management

3.1 Managing Arrays and Partitions Using SAM

Using SAM, you can manage arrays and partitions. You can perform the following array-related functions:

- Manage arrays (see page 20)
  - View array and drive status (see page 20)
  - View and reset array statistics (see page 21)
  - Verify an array (see page 22)
  - Change array owner (see page 23)
  - Change the array name (see page 23)
  - Trust an array (see page 24)
  - Delete an array (see page 24)

- Manage partitions (see page 25)
  - View partition status information (see page 25)
  - Change a partition name (see page 25)
  - Change a partition LUN (see page 26)
  - Control partition access (see page 27)
  - Change a partition's read-ahead cache size (see page 30)
  - Delete a partition (see page 31)

- The X24 Subsystem Getting Started Guide describes the following array and partition functions:

- Arrays
  - Creating an array
  - Stopping the array initialization process
  - Reconstructing an array

  - Expanding array capacity

- Partitions
  - Adding a partition
  - Expanding a partition
- Managing spares

3.2 Managing Arrays

SAM lets you manage your arrays in a variety of ways. You can:

- View array and drive status (see page 20)
- View and reset array statistics (see page 21)
- Verify an array (see page 22)
- Change array owner (see page 23)
- Change the array name (see page 23)
- Trust an array (see page 24)
- Delete an array (see page 24)

3.3 Viewing Array and Drive Status Information

Array status information is available from many pages in SAM. The top panel on all Disk Array Config and LUN Management pages displays an icon for each array with information about the array below it.

In this top panel, critical arrays display a blinking, red, exclamation mark through the array. If a utility is running on the array, the percent complete displays. If any array is critical for any reason other than initializing or reconstructing, you should review the status information and take the appropriate action, such as replacing a disk drive. For more information about the array icons, refer to the Understanding the Array Icons section of the X24 Subsystem Getting Started Guide.

More detailed array and drive information is available from three pages (for information about the fields on each page, click the **Page Help** icon):

- **Monitor Galaxy 65 Subsystem > Status > Storage Array Status**—includes status information for the selected array and its disk drives and partitions.

- **Manage Galaxy 65 Subsystem > Disk Array Config**—includes array status information for the selected array.

- **Manage Galaxy 65 Subsystem > Disk Array Config > Disk Drive Status**—includes disk drive status information for the selected array.

3.3.1 Viewing Array and Partition Statistics

You can view the current array and partition rate and cumulative statistics. The following statistics are available:

- Rate statistics
  - I/O operations per second (IOPS)
  - Bandwidth (in millions of bytes per second)

- Cumulative statistics
  - Number of read operations
  - Number of write operations
  - Number of sectors (512 bytes) read
  - Number of sectors written
  - Current command queue depth for each host port
  - I/O size for each host port
  - Host read/write histogram that shows how many host reads and writes fell into a particular size range. The I/O ranges are based on powers of two.

Tip: This information may be helpful in interpreting performance based on individual system configuration such as HBA, driver configuration, SAN configuration, and host operating system configuration. The statistical information can be useful to profile applications and their usage of an array and partition, which could be used to determine if additional arrays would increase performance and what RAID level is applicable to your needs. You may want to analyze the performance of the same application using different RAID levels to determine which level gives you the best performance. See Appendix A , ”Array Basics”, on page 89 for more details on RAID levels.

Note The statistics are provided as general information for your use, however, they are not intended for benchmarking purposes.

Similar statistics are also available on an aggregate basis for all arrays. For more information, see.

To view the rate statistics:

- From SAM, select **Monitor Galaxy 65 Subsystem > Statistics > Partition Rate Stats**.

To view the cumulative statistics:

- From SAM, select **Monitor Galaxy 65 Subsystem > Statistics > Cumulative Part Stats**.

3.3.1.1 Resetting All Statistics

You can reset the following array and partition statistics to zero:

- Read
- Write
- SecRd
- SecWt

- I/O Size

Note Resetting statistics here resets all statistics for the Galaxy 65 Subsystem.

You may want to reset the statistics if you are monitoring performance. You may also want to reset statistics when you change how you are using a partition.

Note You cannot reset the queue depth value. It always reflects the current I/O queue depth.

To reset all statistics:

1. From SAM, select **Monitor Galaxy 65 Subsystem > Statistics > Reset All Statistics**.
   The Reset All Statistics page displays.

2. Click **Reset Statistics**.
   The system confirms that you want to make the change.

3.3.2 Verifying an Array

The Verify function allows you to verify the data on redundant arrays (RAID 1, RAID 3, RAID 4, RAID 5, RAID 10, and RAID 50):

- RAID 3, RAID 4, RAID 5, and RAID 50: Verifies all parity blocks in the selected array and corrects any bad parity.

- RAID 1 and RAID 10: Compares the primary and secondary drives. If a mismatch occurs, the primary is copied to the secondary.

You may want to verify an array when you suspect there is a problem.

To verify an array:

1. From SAM, select **Manage Galaxy 65 Subsystem > Disk Array Config > Verify Array**.
   The Verify Array page displays with a list of existing arrays.

2. Select the array you want.

3. Click **Verify & Update Array Parity**.

   Verification begins and the percentage of verification completed displays. You can continue to use the array during verification.

   To check the progress of the verification, select **Manage Galaxy 65 Subsystem > Disk Array Config > Array Utility Progress** or any item from the **Disk Array Config** menu. The status of the verification displays in the list of arrays.

3.3.2.1 Stopping the Array Verification Process

You can stop the array verification process.

Note If you stop the verification process, you cannot resume. You must restart from the beginning.

To stop the array verification process:

1 From SAM, select **Manage Galaxy 65 Subsystem > Disk Array Config > Abort an Array Utility**.

The *Abort an Array Utility* page displays with a list of existing arrays.

2 Select the array you want.

3 Click **Abort Array Verification**.

3.3.3 Changing Array Ownership

You can change the ownership of any array between the SMs. When you create an array, SAM automatically selects the owner and balances the number of arrays each SM owns. You can select the array owner when you create an array by clicking **Advanced Options** from the third Create Array page.

In most situations, which SM owns the array does not matter. A single SM owns arrays and dedicated spares. When a SM fails, the other SM assumes temporary ownership of its resources.

Note When you change the ownership of an array, the LUNs assigned to the array's partitions become invalid. After changing ownership, you must assign a new LUN to each array partition.

To change array ownership:

1 From SAM, select **Manage Galaxy 65 Subsystem > Disk Array Config > Change Array Owner**.
The Change Array Owner page displays with a list of existing arrays.

2 Select the array you want.
The Change Array Owner drop-down list shows the current owner.

3 Select the other SM from the drop-down list.

4 Click **Change Array Owner to Storage Manager X (***where* **X** *is the other SM***)**.

5 Assign a new LUN to each array partition.
See section 3.4.3 on page 26.

3.3.4 Changing an Array Name

You can change the name of an array. This does not affect the target ID or LUN values of the array. The Galaxy 65 Subsystem does not allow you to change an array name when a utility is running.

To change an array name:

1 From SAM, select **Manage Galaxy 65 Subsystem > Disk Array Config > Change Array Name**.
The *Change Array Name* page displays with a list of existing arrays.

2 Select the array you want.

3 Enter a new name.
You can use up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (").

4 Click **Change Array Name**.

3.3.5 Trusting an Array

You can use the Trust Array function to bring an array back online by re synchronizing the time and date stamp and any other metadata on a bad disk. This makes the disk an active member of the array again. You might need to do this when:

- One or more disks of an array start up more slowly or were powered on after the rest of the disks in the array. This causes the date and time stamps to differ, which the Galaxy 65 Subsystem interprets as a problem with the “late” disks. In this case, the array will function normally after using Trust Array.
- An array is offline because a drive is failing, you have no data backup, and you want to try to recover the data from the array. In this case, the Trust Array function may work, but only as long as the failing drive continues to operate.

Before you can use this function, you must enable it as described below.

Caution *The Trust Array feature can cause unstable operation and data loss if used improperly. This feature is intended for disaster recovery.*

To trust an array:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Option Configuration**.
   The Option Configuration page displays.
2. For Enable Trust Array, select Enabled.
3. Click **Change Options**.
   The option is only enabled until you use it. After you trust an array, the option reverts back to being disabled.
4. Select **Disk Array Config > Trust Array**.
   The Trust Array page displays with a list of existing arrays.
5. Select the array you want.
6. Click **Trust This Array**.
   The array will be back online.

Note If the array does not come back online, it may be that too many members are offline or the array may have additional failures on the bus or enclosure that Trust Array cannot fix.

3.3.6 Deleting an Array

You can delete an array when you no longer need the array or you need the drives for another use.

Caution *Deleting an array deletes all partitions and data contained in the array.*

Note You cannot delete an array while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the array.
To delete an array:

1. From SAM, select **Manage Galaxy 65 Subsystem > Disk Array Config > Delete an Array**.
   The *Delete an Array* page displays with a list of all existing arrays.

2 Select the array you want to delete.

3 Click **Delete This Array**.
The system asks you to confirm the deletion.

4 Click **OK**.

3.4 Managing Partitions

The SAM software lets you manage partitions in a variety of ways. You can:

- View partition status information (see page 25)
- Change a partition name (see page 25)
- Change a partition LUN (see page 26)
- Control partition access (see page 27)
- Change a partition's read-ahead cache size (see page 30)
- Delete a partition (see page 31)

3.4.1 Viewing Partition Status Information

Partition status information is available from many pages in SAM. The top panel on all Disk Array Config and LUN Management pages displays an icon for each array with information about the array below it.

In this top panel, critical arrays display a blinking, red exclamation mark through the array. If a utility is running on the array, the percent complete displays. If any array is critical for any reason other than initializing or reconstructing, you should review the status information and take the appropriate action, such as replacing a disk drive. For more information about the array icons, refer to the Understanding the Array Icons section of the X24 Subsystem Getting Started Guide.

More detailed partition information is available from two pages (for information about the fields on each page, click **Page Help**):

- **Monitor Galaxy 65 Subsystem > Status > Storage Array Status**—includes partition information for the selected array.
- **Manage Galaxy 65 Subsystem > LUN Management**—includes more detailed partition information and a graphical depiction of the partitions for the selected array.

3.4.2 Changing a Partition Name

You can change the name of a partition. This does not affect the target ID or LUN values of the partition. You cannot change a partition name when a utility is running.

To change a partition name:

1 From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Change Partition Name**. The *Change Partition Name* page displays with a list of all existing arrays.

2 In the *Select an Array to View LUN Information* panel, select the array whose partition you want to rename.

3 In the *Partition Menu* panel, select the current partition name.

4 In the *Change Name* panel, enter the new name.
You can use up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (").

5 Click **Change Partition Name**.

3.4.3 Changing a Partition LUN

You can change the LUN assigned to a partition, as it appears under the Galaxy 65 Subsystem's target ID from the host system's point of view. The change takes place immediately, however, you may need to restart the host system to see the partition at the new LUN.

Note You cannot change the partition's LUN to one that is already in use. If you want to use a LUN that is already in use, you must first reassign the LUN in use.

For more information about LUNs and your Galaxy 65 Subsystem, see section G.4, "Understanding LUNs and Viewing LUN Information", on page 196.

To change a partition LUN:

1 From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Change Partition LUN**. The *Change Partition LUN* page displays with a list of all existing arrays.

2 In the *Select an Array to View LUN Information* panel, select the array whose partition you want to assign a new LUN.

3 In the *Partition Menu* panel, select the partition name.

4 In the *Change LUN* panel, select a new LUN.

5 Click **Change Partition LUN**.

3.4.4 Controlling Partition Access

The Galaxy 65 Subsystem's InfoShield capability lets you specify which hosts can access each partition. This gives you complete control of array access based on your specific needs.

Figure 3–1 shows an example of how you can use InfoShield.

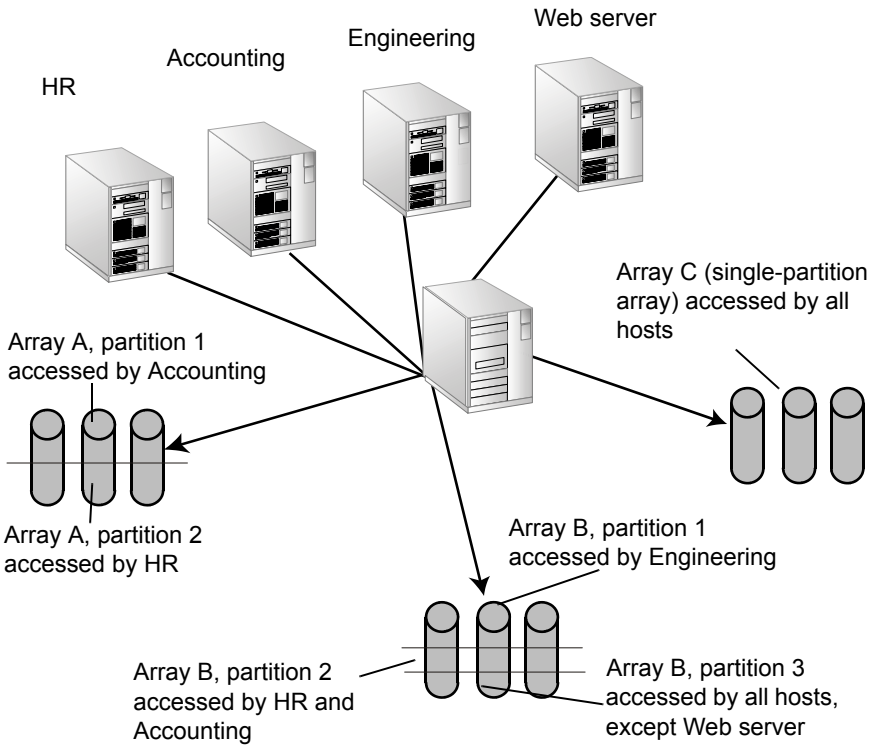

HR
Accounting
Engineering
Web server
Array C (single-partition array) accessed by all hosts
Array A, partition 1 accessed by Accounting
Array A, partition 2 accessed by HR
Array B, partition 1 accessed by Engineering
Array B, partition 2 accessed by HR and Accounting
Array B, partition 3 accessed by all hosts, except Web server

Figure 3–1 InfoShield example

Before you set up InfoShield, you should know the World Wide Name (WWN) for each host that you want to set up. Your SAN administrator should know the WWNs for your network. You can display a list of the last 64 WWNs that the Galaxy 65 Subsystem is aware of on the SAN, and you can give each WWN a nickname of your own. This makes working with the InfoShield feature faster and easier.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 64 specific hosts or all hosts for each partition LUN.

For example, in Figure 3–1, Array A has two partitions. Partition 1 has an include list that contains only Accounting, so only the Accounting server can access partition 1. Array B, partition 3 has an exclude list that contains only the Web server, so all hosts *except* the Web server can access the partition. Array C uses the default setting, Include All Hosts, which permits all hosts to access the array.

3.4.4.1 Viewing Known WWNs

You can view the global host list, which includes the last 64 host WWNs that the Galaxy 65 Subsystem is aware of on your SAN. The Galaxy 65 Subsystem will be aware of any host that was started since the Galaxy 65 Subsystem was last restarted. Typically, hosts scan for devices during their start-up process. When this happens, the Galaxy 65 Subsystem saves the WWN information for the host, but does not

retain the information after you restart the Galaxy 65 Subsystem unless you have given the host a nickname. The list includes the last 64 hosts that started or that you gave a nickname.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, then viewing the WWN list. The host that scanned for devices most recently is first on the list. You can then give the hosts nicknames you recognize. For example, you can use the computer name that has already been assigned to each host, to make InfoShield easier to manage.

To view known WWNs:

- From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Manage Global Host List**.

  The *Manage Global Host List* page displays with a list of known host WWNs and nicknames you have given them. The WWNs are listed according to when they scanned for devices. The host that scanned for devices most recently is listed first.

Note A host's WWN is placed at the top of the known hosts list whenever the host performs a device discovery or bus scanning type of operation.

3.4.4.2 Creating Nicknames for Host WWNs

You can give the hosts on your SAN nicknames that you can easily recognize to make InfoShield easier to manage. For example, you can use the computer name that has already been assigned to each host. The list of known host WWNs and nicknames is called the global host list.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, then viewing the WWN list. The host that scanned for devices most recently is first on the list.

You can give nicknames to up to 64 hosts.

To add or change nicknames for WWNs:

1. From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Manage Global Host List**. The *Manage Global Host List* page displays with a list of known host WWNs and nicknames you have given them. The WWNs are listed according to when they scanned for devices. The host that scanned for devices most recently is listed first.

2. Add or change a host nickname.

To add a new host that is not listed	To change a host nickname that is listed
1 In the Add Host to Global List panel, enter the WWN and nickname.Your SAN administrator should know the WWNs for your network. You can enter up to 15 characters. You can use only letters, numbers, and underscores. 2 Click **Add New Host**.	1 In the Global Host List panel, enter a new nickname for the host you want to change. You can enter up to 15 characters. You can use only letters, numbers, and underscores. 2 Click **Change Host Nickname**.

3.4.4.3 Configuring InfoShield

Once you set up host nicknames, you can easily set up your InfoShield. This is where you determine which hosts can access each partition LUN.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 64 specific hosts or all hosts for each partition LUN.

The InfoShield information is stored as part of the array's metadata using the WWN for each host. If you install a new SM, the array partition's InfoShield will remain. The InfoShield will also remain if you change the partition's LUN.

Note Changes to InfoShield take effect immediately, therefore, you should make changes that limit access to partitions when the partitions are not in use.

To set up InfoShield:

1. From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Partition Menu > InfoShield**. The *InfoShield* page displays.

2. In the *Select an Array to View/Change InfoShield Information* panel, select the array whose partition you want to control access to.

3. In the *Select a Partition to View/Change InfoShield Information* panel, select the partition name.

4. In the InfoShield Type for Array panel, select the InfoShield type you want to use and click **Change InfoShield Type**.

   The panel shows the current InfoShield type in the drop-down list. The default setting for each partition LUN is Include All Hosts. This results in all hosts being able to access all partitions. Changing the InfoShield type does not add or remove any hosts in previously created lists.

   - ***Include All Hosts:*** Permits all hosts on the network to access the selected partition. This is the default InfoShield type. This results in all hosts being able to access the partition. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.

   - ***Include Listed Hosts***: Lets you enter or select the WWNs of the specific hosts you want to be able to access the selected partition. The list of WWNs and nicknames that displays contains the last 64 hosts that started or that you gave a nickname. If you know other WWNs or nicknames, you can enter the WWN or nickname.

   - ***Exclude All Hosts:*** Permits *no* hosts on the network to access the selected partition. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.

   - ***Exclude Listed Hosts***: Lets you enter or select the WWNs or nicknames of the specific hosts you do *not* want to be able to access the selected partition. The list of WWNs and nicknames that displays contains the last 64 hosts that started or that you gave a nickname. If you know other WWNs or nicknames, you can enter the WWN or nickname.

     Whether you use an include or exclude list depends on your needs. You may want to determine which list would be shorter and create the shorter list.

5 If you selected Include **Listed Hosts** or E**xclude Listed Hosts**, you must create a host list.

All hosts already on an include or exclude this for the partition are listed in the *Host Table for Array* panel. You can change a host nickname or delete a host from the list.

To add a host that is already on the global host list, select the host in the *Add Existing Host for Array* panel and click **Add Existing Host**. For more information about the global host list, see 3.4.4.2, ”Creating Nicknames for Host WWNs”, on page 28.

To add a host that is not already on the global host list, enter the host WWN and nickname in the Add New Host for Array panel and click **Add New Host**.

3.4.5 Changing the Read-Ahead Cache Size

You can change the read-ahead cache size for each partition. This setting controls how much data the SM reads ahead and stores in its cache memory during sequential reads.

If you want to change this size, you should be prepared to monitor the system performance using the array statistics and adjust the size until you find the optimal size for your application.

The default setting is one chunk for the first access in a sequential read and one stripe for all subsequent accesses. The size of the chunk is based on the chunk size used when you created the array (default is 64 KB). The SMs treat volumes and mirrored arrays (RAID 1) internally as if they have a stripe size of 64 KB, even though they are not striped.

If you specify a read-ahead cache size, that amount of data is read first, and the same amount is read for all read-ahead accesses.

Read-ahead is triggered by two back-to-back accesses to consecutive logical block address (LBA) ranges. Read-head can be forward (that is, increasing LBAs) or reverse (that is, decreasing LBAs).

Setting the read-ahead size to 0 turns off read-ahead cache. This is useful if the host is triggering read-ahead for what are random accesses. This can happen if the host breaks up the random I/O into two smaller reads, triggering read-ahead. You can use the partition statistics read histogram to determine what size accesses the host is doing.

Setting the read-ahead size to a very large size (say four to five stripes) can help improve the performance of multiple (three or more) sequential read streams, in some cases improving performance by three times. This would be useful for providing multiple video streams, for example.

To change the read-ahead cache size:

1 From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Partition Menu > Read Ahead Cache**.
The Read Ahead Cache page displays with a list of all existing arrays

2 In the Select an Array to View LUN Information panel, select the array whose partition you want to assign a new read-ahead cache size.

3 In the Partition Menu panel, select the partition name.

4 In the Partition Read Ahead Size panel, select the size you want.
The current size displays in the drop-down list with ** next to it.

5 Click **Set Read Ahead Cache Size**.

3.4.6 Deleting a Partition

You can delete a partition when you no longer need it and you want to use the space for another purpose.

Caution *Deleting a partition deletes all data contained in the partition.*

Note You cannot delete a partition while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the partition.

To delete a partition:

1 From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Partition Menu > Delete Partition**.
The *Delete Partition* page displays with a list of all existing arrays.

2 In the *Select an Array to View LUN Information* panel, select the array whose partition you want to delete.

3 In the *Partition Menu* panel, select the partition name.

4 Click **Delete Partition**.

Chapter 4

System Status

4.1 Monitoring System Status Using SAM

You should monitor your system regularly to ensure that the Galaxy 65 Subsystem, disk drives, and arrays are working properly. The Galaxy 65 Subsystem and SAM let you monitor the status several ways:

- Remote notification (see page 33)
- All log information (see page 35)
- Overall and cumulative statistics (see page 36)
- Debug log (see page 81)

4.2 Setting Up Remote Notification

Remote notification lets you receive information about specific Galaxy 65 Subsystem events by e-mail. You can select the types of events and up to four e-mail addresses. You can view the current settings by selecting **Manage Galaxy 65 Subsystem > Remote Configuration**.

Remote notification requires that you set up two items:

- Events to be monitored
- E-mail addresses to send events to
  - By category
  - By specific event
- E-mail addresses to send events to

4.2.1 Starting and Stopping Remote Notification

You can start or stop remote notification at any time. If you start remote notification, be sure to select event categories or specific events to monitor.

To start or stop remote notification:

1. From SAM, select **Manage Galaxy 65 Subsystem > Remote Configuration > Events to be Monitored**. The *Current Settings* page displays
2. Select whether you want to start or stop remote notification.
3. Click **Change Notification**.

4.2.2 Setting Up the Events to be Monitored

You can select the events you want to monitor using remote notification in two ways:

- By category
- By specific event

You can combine the event selections in any way that meets your needs. When one of these events occurs on the Galaxy 65 Subsystem, SAM sends a message to the e-mail addresses that you have set up.

To set up events:.

1. From SAM, select **Manage Galaxy 65 Subsystem > Remote Configuration > Select Event Categories**.
   The *Select Event Categories* page displays.
2. Select which event categories, if any, you want to trigger an e-mail message.
3. Click **Change Monitored Event Categories**.
4. Select **Manage Galaxy 65 Subsystem > Remote Configuration > Select Specific Categories**.
   The Select Specific Events page displays.
5. Select the specific events, if any, you want to trigger an e-mail message.
   Use the buttons at the bottom of the page to select or clear all events.
6. Click **Change Individual Monitored Events**.

4.2.3 Setting Up the E-mail Addresses

You can send events to up to four e-mail addresses for remote notification. You can also test the e-mail setup by clicking **Send Test E-mail**.

To set up e-mail addresses:

1 From SAM, select **Manage Galaxy 65 Subsystem > Remote Configuration > E-mail Configuration**. The E-mail Configuration page displays.

2 Enter the following information:

- **E-Mail Address** 1 through 4: Enter up to four e-mail addresses you want to receive notification of Galaxy 65 Subsystem events. Enter the addresses in the format: user_name@domain_name.
- **E-Mail Comment**: Enter text that you want sent with e-mail messages. For example, you might want to identify something about the location, name, or use of this Galaxy 65 Subsystem.
- **Mail Server**: Enter the IP address of the SMTP server to use for the e-mail messages. Contact your system administrator for more information.
- **Domain Name**: For some networks, you need to enter the domain name. Contact your system administrator for more information.
- **Sender Name**: Enter the Galaxy 65 Subsystem's administrator's name.

3 Click **Change E-mail Info**.

4.3 Saving Log Information to a File

You can save Galaxy 65 Subsystem event and debug log information to a file. The file contains selected log information, including:

- Event log (refer to the Galaxy 65 Subsystem Getting Started Guide)
- Diagnostic debug logs)
- Device status

The device status information is always included.

You can enter contact information for inclusion in the log information file. This helps identify the issue and contact information when these logs are being collected for diagnostic purposes.

To save log information to a file:

1 From SAM, select **Manage Galaxy 65 Subsystem > Debug Utilities > Save Log Files**.
The *Save Log Files* page displays.

2 Enter any contact information you want included in the log file.
By doing so, your contact information and comments will help create a unique document that may be used to identify the issue and origin when these logs are being collected for diagnostic purposes.

3 Select the type of information you want included in the log from the File Contents list.

4 Click **Generate Log Information** to save the current contact information, generate the requested information, and proceed to the log disposition page.

5 Click **Download Selected Logs to File** to save the logs to a file on the host system or anywhere accessible on your network.

6 When the File Download window displays, select “Save this file to disk” and click **OK**.

7 Navigate to where you want to save the file, enter the file name, and click **Save**.
The Download Complete window displays.

8 Click **Close**.

4.4 Displaying Overall Statistics

You can display two types of aggregate statistics for all arrays:

- Rate statistics (for all arrays and each individual array):
  - I/O operations per second (IOPS)
  - Bandwidth (in millions of bytes per second)

- Cumulative statistics for all arrays
  - Number of read operations
  - Number of write operations
  - Total sectors (512 bytes) read
  - Total sectors written
  - Total current command queue depth across all LUNs
  - Host read/write histogram that shows how many host reads and writes fell into a particular size range. The I/O ranges are based on powers of two.

Similar statistics are also available for individual arrays and partitions. For more information, see 3.3.1, ”Viewing Array and Partition Statistics”, on page 21.

Tip: This information may be helpful in interpreting performance based on individual system configuration such as HBA, driver configuration, SAN configuration, and host operating system configuration. The statistical information can be useful to profile applications and their usage of an array, which could be used to determine if additional arrays would increase performance and what type of RAID level is applicable to your needs. You may want to analyze the performance of the same application using different RAID levels to determine which level gives you the best performance. See Appendix A, ”Array Basics”, on page 89 for more details on RAID levels.

Note The statistics are provided as general information for your use, however, they are not intended for benchmarking purposes.

To view the overall rate statistics:

- From SAM, select **Monitor Galaxy 65 Subsystem > Statistics**
  To view the cumulative statistics:

- From SAM, select **Monitor Galaxy 65 Subsystem > Statistics > Cumulative Stats**.

4.4.1 Resetting the All Statistics

You can reset the following statistics to zero:

- Read
- Write
- SecRd
- SecWt
- I/O Size

Note Resetting statistics here resets all statistics for the Galaxy 65 Subsystem.
You may want to reset the statistics if you are monitoring performance. You may also want to reset statistics when you change how you are using the partition.

Note You cannot reset the queue depth value. It always reflects the current I/O queue depth.

To reset all statistics:

1. From SAM, select **Monitor Galaxy 65 Subsystem > Statistics > Reset All Statistics**.
   The *Reset All Statistics* page displays.

2. Click **Reset Statistics**.
   The system confirms that you want to make the changes

Chapter 5

Configuring the Galaxy 65 System

SAM lets you configure settings and perform a variety of functions on the Galaxy 65 Subsystem. You can:

- Configure the LAN-related settings (page 40)
- Change the date and time (see page 43)
- View LUN information (see page 43)
- Change management LUNs (see page 44)
- Change the alarm mute setting (see page 44)
- Lock the cache setting (see page 45)
- Enable or disable the battery (see page 46)
- Change the utility priority (see page 46)
- Rescan all ports (see page 47)
- Pause I/O (see page 47)
- Save and restore a configuration file (see page 48)
- Restore the default settings (see page 50)
- Update the software (see page 51)

The Galaxy 65 Subsystem Getting Started Guide describes the following Galaxy 65 Subsystem settings and functions:

- Setting up the host ports:
  - Internal hubs
  - Loop ID
  - Link speed

- Setting up the FC device ports
  - Loop ID
  - Link speed

5.1 Configuring the LAN-related Settings

You can configure several LAN-related settings for the Galaxy 65 Subsystem:

- IP settings (refer to the Galaxy 65 Subsystem Getting Started Guide)
- Telnet settings (see page 40)
- SNMP settings (see page 40)
- System information (see page 41)
- Passwords (see page 41)
- Security options (see page 42)

5.1.1 Configuring the Telnet Timeout

You can set the Telnet timeout setting, which controls the number of idle minutes before the Telnet session times out. The default is no timeout, which is shown as 0 minutes.

To set the Telnet timeout:

1 In SAM, select **Manage Galaxy 65 Subsystem > General Config > LAN Configuration**.
The *LAN Configuration* page displays.

2 In the Telnet Configuration panel, enter the timeout period.

3 Click **Change LAN Configuration**.

5.1.2 Configuring the SNMP Settings

You can set four Simple Network Management Protocol (SNMP)-related settings:

- **Traps Enabled**: On or off toggle to enable SNMP traps. The default is No (disabled).
- **SNMP Trap Host**: Host computer's IP address that is set up to receive SNMP traps. The default is 0.0.0.0.
- **Trap Filter**: Informational, Warning, or Error. The default is Warning.
- **Event Filter**: Informational, Warning, or Error. The default is Warning.

To set the SNMP settings:

1 In SAM, select **Manage Galaxy 65 Subsystem > General Config > LAN Configuration**.
The *LAN Configuration* page displays.

2 In the *SNMP Configuration* panel, select the options you want.

3 Click **Change LAN Configuration**.

5.1.3 Configuring the System Information

You can set four system information settings:

- **System Name**: Name of the Galaxy 65 Subsystem as seen by other systems on the LAN. You can enter up to 74 characters. The default is Uninitialized Name.
- **System Contact**: Name of a contact person responsible for the Galaxy 65 Subsystem. You can enter up to 74 characters.
- **System Location**: Location of the Galaxy 65 Subsystem. You can enter up to 74 characters.
- **System Information**: Additional information about the Galaxy 65 Subsystem. You can enter up to 74 characters.

To configure the system information:

1. In SAM, select **Manage Galaxy 65 Subsystem > General Config**.
   The System Information page displays.
2. Enter the system information.
3. Click **Change System Configuration**.

5.1.4 Setting Passwords

You can set passwords for the following:

- Monitor User Password: These users only have access to the functions on the Monitor Galaxy 65 Subsystem menu. The default is monitor. Up to three monitor-only users can be logged in at a time. You can use up to 31 characters. You can use only letters, numbers, and underscores.
- **Manage User Password:** These users have access to all SAM functions. The default is manage. Only one manage user can be logged in at a time. You can use up to 31 characters. You can use only letters, numbers, and underscores.
- **Telnet User Password:** Password for accessing the SM using the Ethernet port and Telnet. The default is null (press **Enter**). You can use up to 15 characters. You can use only letters, numbers, and underscores.
- **FTP User Login:** Login name for FTP access to the SM. You can use FTP to download software updates. The default is flash. You can use up to 15 characters. You can use only letters, numbers, and underscores.
- **FTP User Password**: Password for FTP access to the SM. The default is flash. You can use up to 15 characters. You can use only letters, numbers, and underscores.
- **SNMP Read Community**: SNMP read password. The default is Public. You can use up to 15 characters. You can use only letters, numbers, and underscores.
- **SNMP Write Community**: SNMP write password. The default is Private. You can use up to 15 characters. You can use only letters, numbers, and underscores.

To set SAM passwords:

1 From SAM, select **Manage Galaxy 65 Subsystem > General Config > Passwords/Security**. The *Passwords/Security* page displays.

2 In the *Password Configuration* panel, enter the passwords you want.

3 Click **Change**.

5.1.5 Configuring the Security Options

You can enable or disable the following LAN-related functions:

- **FTP Capability**: Controls access to the SMs using file transfer protocol (FTP), which permits you to upgrade the SM's LAN Subsystem software. The default is enabled.
- **Telnet Capability**: Controls access to the SMs using Telnet, which permits you to manage the SMs using your LAN. The default is enabled.
- **HTTP**: Controls access to the SMs using hypertext transfer protocol (HTTP), which permits you to manage the SMs using SAM. The default is enabled.
- **SNMP Capability**: Controls the availability of SNMP, which permits remote monitoring of the SM using your LAN. The default is enabled.
- **Internet Debug**: Used for diagnosing problems during the technical support process. We recommend that this remain disabled unless support personnel tell you to enable it. The default is disabled. You must restart both SMs for the change to take effect. Select **Shutdown/Restart** from the SAM menu.
- **In-Band Management**: Controls whether you can use the Galaxy 65 Configuration Application Programming Interface (CAPI) to access the SM. Disabled means the SM does not have a management LUN assigned. Click the blue text to access the page where you can assign the management LUN.

To change any of the security options:

1 From SAM, select **Manage Galaxy 65 Subsystem > General Config > Passwords/Security**. The *Passwords/Security* page displays.

2 In the *Security Configuration* panel, select the options you want.

3 Click **Change**.

5.2 Changing the Date and Time

You can change the Galaxy 65 Subsystem's date and time.

To set the Galaxy 65 Subsystem's date and time:

1 From SAM, select **Manage Galaxy 65 Subsystem > General Config > Set Date/Time**.
The *Set Date/Time* page displays.

2 In the *Set* Galaxy 65 Subsystem *System Date* panel, select the month, day, and year.

3 In the *Set* Galaxy 65 Subsystem *System Time* panel, enter time using a 24-hour clock.

The Time Zone field controls the time stamp on e-mail messages sent for the Remote Notification function.

4 Click **Change Date/Time**.

5.3 Understanding LUNs and Viewing LUN Information

Each SM supports up to 64 FC logical unit numbers (LUNs), or 128 after a failover, that are numbered zero through 63. There are three different types of LUNs: management (also called CAPI), EMP, and partition. You can view information about each LUN, see section 5.3.1 on page 44.

The three types of LUNs have the following characteristics:

- **Management (CAPI) LUN**: Allows CAPI to configure the SM. Each SM can have a management LUN. You only need to assign a management LUN if you are using CAPI to configure the SM over a host port using SCSI protocol extensions. You are using CAPI only if your company has written a program to monitor and manage the Galaxy 65 Subsystem. If you are not using CAPI, you can set the management LUN to NONE. If you are using CAPI, you can set it to a value of 0-63.

Note Most UNIX, Linux, and Macintosh operating systems require that the management LUN be set to a higher value than all array LUNs. Before creating your first array, change the management LUN to a higher value. If you are using software that your company developed to configure and manage the controller (this application uses CAPI to communicate with the controller), you must have a management LUN. If you are not using software that your company developed, and therefore are not using CAPI, select NONE as the management LUN. This allows your first array to be seen at LUN 0.

- **EMP LUNs:** Allow access to EMPs. You can set an EMP LUN to a value of 0-63 or NONE. NONE means that the EMP cannot be accessed via a LUN. For information about changing the EMP LUN, see Appendix Fsection F.2.1, "Setting the EMP LUN", on page 184.

- **Partition LUNs**: Allow access to array partitions on the Galaxy 65 Subsystem. You can set partition LUNs to any numeric value from 0-63. For information about changing the partition LUN, see 3.4.3, "Changing a Partition LUN", on page 26.

5.3.1 Viewing LUN Information

You can view information for each existing LUN.

To view LUN information:

1 From SAM, select **Monitor Galaxy 65 Subsystem > Status > LUN Information**.
The LUN Information page displays listing each existing LUN along with the node WWN, array name, and partition name.

5.4 Changing Management LUNs

Each SM has a management LUN (also called the CAPI LUN) that you can change. These LUNs allow the SM Configuration Application Programming Interface (CAPI) to configure the SMs. You need to assign a management LUN only if you are using CAPI to configure the SM over a host channel using SCSI protocol extensions. If you are not using CAPI, you can set the management LUN to NONE. If you are using CAPI, you can set it to a value of 0-63.

Note Most UNIX, Linux, and Macintosh operating systems require that the management LUN be set to a higher value than all array LUNs. Before creating your first array, change the management LUN to a higher value. If you are using software that your company developed to configure and manage the controller (this application uses CAPI to communicate with the controller), you must have a management LUN. If you are not using software that your company developed, and therefore are not using CAPI, select NONE as the management LUN. This allows your first array to be seen at LUN 0.

To change the management LUNs:

1 From SAM, select **Manage Galaxy 65 Subsystem > LUN Management > Change SM LUN**.
The *Change SM LUN* page displays.

2 Select the LUN you want to use for each SM:

Note: Use this setting if you are not using CAPI to configure the Galaxy 65 Subsystem.

- Any number between 0 and 63: Select a specific number if you want the management LUN to stay the same when you restart the Galaxy 65 Subsystem (this change takes effect following a shutdown reboot).

3 Click **Change Management LUN**.

5.5 Changing the Alarm Mute Setting

You can enable or disable the audible alarm that sounds when the Galaxy 65 Subsystem becomes too hot, detects low or high voltage, or an array becomes critical or goes offline. Changing the mute setting lets you turn off the alarm when it is sounding. You should turn it back on after resolving the problem.

You can also use the Mute button on the Galaxy 65 to turn off the alarm when it sounds.

The alarm sounds for temperature or voltage conditions (events). Warning events are generated when the temperature or voltage enters the warning range. Shutdown events are generated when the temperature or voltage enters the shutdown range. After reaching the shutdown range, the Galaxy 65

Subsystem will not function. You must resolve the problem and restart the Galaxy 65 Subsystem. If the problem is not resolved, it will shut down again.

Alarm conditions trigger an event message that displays in the event log.

Table 5–1 shows the temperature and voltage thresholds for each alarm and how to resolve the problem.

Table 5–1 Alarm thresholds

Alarm threshold	**What to do when the alarm sounds**
Galaxy 65 Subsystem internal temperature • Warning: 0°C to 4°C and 66°C to 70°C • Shutdown: <0°C and >70°C	• Check SAM to confirm what the alarm means by clicking **Event Log** on any page. • Check the ambient temperature and lower it, if needed. Ambient temperature should be less than 40°C. • Check that the Galaxy 65 Subsystem has good airflow clearance.
SM CPU temperature • Warning: 0°C to 4°C and 91°C to 100°C • Shutdown: <0°C and >100°C	• Same as above.

To enable or disable the alarm:

1 From SAM, select **Manage Galaxy 65 Subsystem > General Config > Audio Alarm**. The Audio Alarm page displays.

2 Select the alarm option you want.

3 Click **Change Configuration**.

5.6 Controlling Host Access to the Galaxy 65's Write-back Cache Setting

You can prevent host systems from using SCSI mode-select commands to change the Galaxy 65 Subsystem's write-back cache setting. Some operating systems disable write cache. If cache lock is enabled, the host cannot change the cache setting. The default setting is disabled.

This option is useful in some environments where the host system disables the Galaxy 65 Subsystem's write-back cache, resulting in degraded performance.

To lock the cache setting:

1 From SAM, select **Manage Galaxy 65 Subsystem > General Config > Option Configuration**. The *Option Configuration* page displays.

2 Select the Host Control of Write-back Cache option you want.

3 Click **Change Options**.

5.7 Enabling and Disabling the Battery

If you are not using a battery in your Galaxy 65 Subsystem, the Galaxy 65 Subsystem will sound an alarm. To eliminate the alarm, you can disable the battery. The default setting is battery enabled.

Notes

1. You should only disable the battery if you are running the Galaxy 65 Subsystem with an Uninterruptible power supply (UPS), so that you will not lose power to the Galaxy 65 Subsystem.
2. If you disable the battery, the Galaxy 65 Subsystem will *not* give any warnings, nor will it disable the write-back cache.
3. If you change this setting, you must restart the Galaxy 65 Subsystem for the change to take effect.

To change the battery setting:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Option Configuration**.
   The *Option Configuration* page displays.
2. Select the Battery option you want.
3. Click **Change Options**.
   You must restart the Galaxy 65 Subsystem for the change to take effect.
4. Select **Shutdown/Restart** from the SAM menu.

5.8 Changing the Utility Priority

You can change the priority at which all utilities (Verify, Reconstruct, Expand, and Initialize) run when there are active I/O operations competing for the Galaxy 65 Subsystem's CPU. The choices are:

- High (default)
- Medium
- Low

For example, select High if your highest priority is to get the array back to a fully fault-tolerant state. This causes heavy I/O with the host to be slower than normal. Select Low priority if streaming data without interruption, such as for a Web server, is more important than data redundancy. This allows the Reconstruct or other utility to run at a slower rate with minimal effects on host I/O.

To change the utility priority:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Option Configuration**.
   The *Option Configuration* page displays.
2. Select the Utility Priority option you want.
3. Click **Change Options**.

5.9 Rescanning All Ports

You can tell the Galaxy 65 Subsystem to scan all disk ports for new or removed disk drives. You can use this option when you install or remove disk drives. The rescan temporarily pauses all I/O processes, then resumes normal operation.

If you are using an enclosure with an EMP, the Galaxy 65 Subsystem performs a rescan automatically. With an EMP, the EMP detects the change in drive status and updates the Galaxy 65 Subsystem about removed drives almost immediately; however, installed drives will be detected after a three-minute delay. This delay is to allow the new drives to spin up.

To rescan all ports:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities**.
   The *Rescan* page displays.

2. Click **Rescan**.

5.10 Pausing I/O

Most drive enclosures allow you to remove and replace drives while FC device port activity continues. However, you may still want to pause I/O if you are replacing more than one disk drive. The Hot Swap Pause option suspends activity on all device channels used in the Galaxy 65 Subsystem, thereby ensuring data integrity on the connected drives and arrays.

Caution *Pausing I/O halts active I/O to the host.*

Note If you are not sure that your enclosure supports hot swapping, use the Hot Swap Pause option before you remove or replace any drives in an array.

To pause I/O:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Hot Swap Pause**.
   The *Hot Swap Pause* page displays.

2. Click **Pause**.

3. When you have replaced the drive, resume I/O activity by clicking **Unpause**.

Caution *Do not stay in the Hot Swap Pause mode for too long; otherwise, an operating system time-out may occur (the time varies according to the operating system). For example, in Windows NT, the default limitation during I/O activity is 10 seconds.*

5.11 Saving and Restoring a Configuration File

You can save all of your Galaxy 65 Subsystem configuration settings to a file and restore that file.

5.11.1 Saving a Configuration File

You can save all of your Galaxy 65 Subsystem configuration settings to a file. This lets you make a backup of your settings. The configuration file contains all Galaxy 65 Subsystem configuration information including the following settings:

- FC host port
- FC device port
- Enclosure management
- Options
- Disk
- LAN
- Audio alarm
- Passwords/security
- Remote notification

Important **It does not include any array or partition information.**

To save a configuration file:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Configuration Utilities > Save Config File**.
   The *Save Config File* page displays.

2. Click **Save Configuration File** to save the current Galaxy 65 Subsystem configuration to a file on the host system or anywhere on your network.
   The *File Download* window displays.

3. Select **Save this file to disk** and click **OK**.
   The *Save As* window displays.

4. Navigate to where you want to save the file and enter the file name.

5. Click **Save.**

5.11.2 Restoring a Configuration File

You can restore a saved Galaxy 65 Subsystem configuration file. This lets you revert back to previous settings or “clone” one Galaxy 65 Subsystem’s settings to another Galaxy 65 Subsystem. You must use SAM to connect to the Galaxy 65 Subsystem where you want to restore the file.

To restore a configuration file:

1 From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Configuration Utilities > Restore Config File**.
The *Restore Config File* page displays.

2 Select the option you want:

- **Use Current IP Addresses**: Restores the configuration file to the Galaxy 65 Subsystem that SAM is currently connected to and retains the currently assigned IP addresses. Use this to restore a backup configuration file to the current Galaxy 65 Subsystem without changing the IP addresses of the Galaxy 65 Subsystem. This option ignores the IP addresses contained in the configuration file.

- **Use New IP Addresses**: Restores the configuration file to the Galaxy 65 Subsystem SAM is currently connected to and changes the Galaxy 65 Subsystem's IP addresses to what you enter here. Use this option to clone the Galaxy 65 Subsystem and change the IP addresses to what you enter. This option ignores the IP addresses contained in the configuration file. Enter the IP Address, Subnet Mask, and IP Gateway for both SMs on the same Galaxy 65 Subsystem. After the file is restored, you must reconnect to the Galaxy 65 Subsystem using one of the new IP addresses.

- **Use Restore File IP Addresses**: Restores the configuration file to the Galaxy 65 Subsystem that SAM is currently connected to and changes the IP addresses to those contained in the configuration file. Use this to restore a configuration file to the current Galaxy 65 Subsystem whenever the IP addresses in the configuration file are the IP addresses you want assigned to the Galaxy 65 Subsystem. After the file is restored, you may need to reconnect to the Galaxy 65 Subsystem using one of the IP addresses from the file.

3 Click **Continue**.

A new page displays. The information on the new page depends on your selection in the previous page.

4 If you chose the Use New IP Addresses option, enter the new IP addresses here and click **Continue Restore Process**.

5 Click **Browse** to navigate to the Galaxy 65 Subsystem configuration file on the host system or anywhere on your network.
The *Choose File* window displays.

6 Navigate to the file and select it.

7 Click **Open**.

8 Click **Restore Configuration File**.

5.12 Viewing and Restoring Default Settings

You can view and restore all of the Galaxy 65 Subsystem's default settings.

5.12.1 Viewing Default Settings

You can view the Galaxy 65 Subsystem's default settings as well as the current settings.

To view the default settings:

- From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Configuration Utilities**.
  The *Show Changed Settings* page displays.

5.12.2 Restoring Default Settings

You may want to do this if the Galaxy 65 Subsystem is not working properly and you cannot determine why. This lets you then change the settings that are critical to your configuration.

You can also view all of your current settings and a compare them to the default settings.

Restore Defaults does not affect any settings related to arrays or partitions. This restores all configuration settings except:

- Management (CAPI) LUN
- IP settings (addresses, subnet mask, and gateway)
- Device port link speeds

To see a list of the current settings and the default settings, click the blue **See Restore Default Changes** text.

To restore the default settings:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Restore Defaults**.
   The *Restore Defaults* page displays.

2. Click **Restore Defaults**.
   You must restart the Galaxy 65 Subsystem for the change to take effect.

3. Select **Shutdown/Restart** from the SAM menu.

5.13 Updating Software

You can update the Galaxy 65 Subsystem software from SAM using a software package file. Information regarding the latest release of software and software package files are available from your supplier.

SAM automatically updates only those types of software that require updating.

Note You should always update the software on both Storage Manager modules. The update process puts the SM module offline during the update process, which takes about ten minutes for each SM module.

To update software:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Load Software**.

   The *Load Software* page displays, which describes the two-step update process and lists your current software versions.

2. Click **Browse** to select to the software package file you downloaded.
   The *Choose File* window displays.

3. Navigate to the software package file and select it.

4. Click **Open**.

   The *Load Software* page displays.

5. Click **Load Software Package File.**

   If the system finds a problem with the file, it displays a message at the top of the page. To resolve the problem, try the following:

   - Select the file again (be sure that you select the software package file that you downloaded from the Web site)
   - Download the file again, in case it got corrupted (do not attempt to edit the file)

   After about 30 seconds, the Load Software for Galaxy 65 page displays. This page lets you know whether the file was validated and what software components are in the file. The system only updates the software that has changes.

6. If you want to force all of the software components to load, even if they have not changed, select the **Force load of all files even if versions match** option.

7. Click **Proceed with Code Update**.

   The update process takes about ten minutes to complete. SAM returns to the Load Software page when update is complete.

8. Connect to the other SM module and repeat steps 1 through 7.

Chapter 6

Managing Disk Drives & Enclosures

SAM lets you control a variety of functions related to devices and enclosure management processor (EMP) enclosures connected to your Galaxy 65 Subsystem.

- For devices, you can:
  - Display device information (see page 53)
  - Clear metadata from a disk drive (see page 54)
  - Enable or disable write-back cache (see page 55)
  - Display disk cache status (see page 55)
  - Enable or disable changes to SMART (see page 55)
  - Blink a drive LED (see page 56)
  - Take down a disk drive (see page 56)
  - Test a disk drive (see page 57)

- For EMP enclosures, you can:
  - Change the EMP LUN (see page 57)
  - Change additional EMP settings (see page 58)

6.1 Managing Disk Drives

SAM lets you control a variety of functions related to disk drives. You should also refer to your disk drive or enclosure documentation for information about related functions.

6.1.1 Displaying Disk Drive Information

You can display two types of information about disk drives:

- A list of all drives connected to the Galaxy 65 Subsystem

- The status of all disk drives in an array

6.1.1.1 Displaying All Devices

You can display a list of all connected devices. For more information about the fields that display for each device, click **Page Help** near the bottom of the page.

Disk drives that are not members of any array are listed as Available. Drives that contain leftover metadata from a previous array are listed as Leftover. This situation can arise if drives are removed and reinserted or the drives failed temporarily and are not operating again. To clear leftover metadata, use the Clear Metadata function. SeeAppendix Fsection F.1.2, ”Clearing Metadata from a Drive”, on page 177.

To display all disk drives:

- From SAM, select **Monitor Galaxy 65 Subsystem > Status > Display All Devices**.

The *Display All Devices* page displays listing all connected devices.

6.1.1.2 Viewing Disk Drive Status

You can view the status of the drives in an array.

Note If a disk drive has failed or malfunctioned, it may not be listed.

To view drive status:

1. From SAM, select **Manage Galaxy 65 Subsystem > Status > Disk Drive Status**.
   The *Disk Drive Status* page displays listing all arrays.

2. Select the array whose disk drive status you want to see.

6.1.2 Clearing Metadata from a Disk Drive

All of the member disk drives in an array contain metadata in the first sectors. The Galaxy 65 Subsystem uses the metadata to identify array members after restarting or replacing SMs.

You can clear the metadata if you have a disk drive that was previously a member of an array. Disk drives in this state display Leftover in the Display All Devices page and in the Clear Metadata page. After you clear the metadata, you can use the disk drive in an array or as a spare.

To clear metadata from a disk drive:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Disk Drive Utilities > Clear Metadata**.
   The *Clear Metadata page* displays listing all available and leftover disk drives.

2. Select the disk drive whose metadata you want to clear.

3. Click **Clear Metadata from Selected Device**.
   You can now use this disk drive in an array or as a spare.

6.1.3 Enabling and Disabling Write-back Cache

You can control the write-back cache setting for all of your disk drives at once. Changes take effect after the next rescan or restart.

This can be set to Enable, Disable, or Don't Modify (which means the Galaxy 65 Subsystem should not change any disk drive's write-back cache settings). The default setting is Disable.

Typically, if your disk drives are part of an array, you do not want to turn on their write-back cache. The Galaxy 65 Subsystem is already using write-back cache to improve performance. Turning on write-back cache on the disk drive *may* improve performance in some cases, depending on the type of array and how you are using it.

Any disk drives with write-back cache enabled should be connected to an Uninterruptible power supply (UPS) in case of power failure. If the disk drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk drive's write-back cache.

Caution *We recommend that you disable write-back cache on disk drives. Some disk drives delete their write-back cache if they encounter an internal error, resulting in lost data.*

To change the write-back cache setting:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Disk Configuration**.
   The *Disk Configuration* page displays.
2. Select the Write-back Cache option you want.
3. Click **Change Disk Option Configuration**.
4. Select **Manage Galaxy 65 Subsystem > Utilities** and click **Rescan** to have your changes take effect.

6.1.4 Displaying Disk Drive Cache Status

You can display the cache status of each disk drive. Any disk drives with write-back cache enabled should be connected to a UPS in case of power failure. If the disk drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk's write-back cache.

To display disk cache status:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Disk Drive Utilities > Display Disk Cache**.
   The *Display Disk Cache* page displays.
2. Select the drive whose cache settings you want to see.

6.1.5 Enabling and Disabling SMART Changes

You can enable or disable the ability to change the Self-Monitoring, Analysis and Reporting Technology (SMART) settings for all disk drives connected to the Galaxy 65 Subsystem. This can be set to **Enable**, **Disable**, or **Don't Modify** (which means the Galaxy 65 Subsystem should not change any disk drive's SMART settings). The default setting is Don't Modify.

When you enable SMART, the SMART events are recorded in the event log, which lets you monitor your disk drives or analyze why a disk drive failed. For more information about the event log, refer to the X24 Subsystem Getting Started Guide. On most disk drives, SMART is disabled by default by the manufacturer.

To enable or disable SMART changes:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Disk Configuration**.
   The *Disk Configuration* page displays.
2. Select the SMART option you want.
3. Click **Change Disk Option Configuration**.
4. Select **Manage Galaxy 65 Subsystem > Utilities** and click **Rescan** to have your changes take effect.

6.1.6 Blinking a Drive LED

You can blink the LED on a specific disk drive.

To blink a drive LED:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Disk Drive Utilities**.
   The Blink Drive LED page displays listing all devices.
2. Select the disk drive whose LED you want to blink.
3. Click **Blink Selected Device LED**.
   The disk drive continues blinking its LED until you click **Unblink Selected Device LED**.

6.1.7 Taking Down a Disk Drive

Caution *This function is only for testing and could result in data loss. It should not be used in normal operation.*

The Down Drive function sets the status of a disk drive in a fault-tolerant array to down. This forces the Galaxy 65 Subsystem to remove it from the array and marks the array as critical. The downed disk drive is marked as Leftover and you cannot add it back to the array. You also cannot take down any additional disk drives in the array.

If you have a properly sized dedicated or global spare, this will cause a reconstruct on the affected array. For more information about reconstructing an array, refer to the X24 Subsystem Getting Started Guide.

To take down a disk drive:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Disk Drive Utilities > Down Disk Drive**.
   The *Down Disk Drive* page displays listing all devices.
2. Select the disk drive you want to take down.
3. Click **Down Selected Drive**.

Before you can use the disk drive again, you must clear its metadata. SeeAppendix F section 6.1.2, ”Clearing Metadata from a Disk Drive”, on page 54.

6.1.8 Testing a Disk Drive

This function issues a Test Unit Ready (TUR) command to the selected disk drive. This just tells you that the disk drive can respond, but it still may not be functioning properly.

To test a disk drive:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Disk Drive Utilities >Test Unit Ready**. The *Test Unit Ready* page displays listing all devices.
2. Select the disk drive you want to test.
3. Click **Test Unit Ready**.

If the TUR was successful, Test Unit Ready STATUS OK displays.

If the TUR was not successful, a failure message displays.

6.2 Managing Enclosures

An enclosure management processor (EMP) is a device in the enclosure from which the Galaxy 65 Subsystem can inquire about the enclosure’s environmental conditions such as temperature, power supply and fan status, and the presence or absence of disk drives. The Galaxy 65 Subsystem can also tell the EMP about RAID activities such as disk drive rebuilds and failed disk drives.

If you have only one EMP, the configuration settings are automatically enabled when the Galaxy 65 Subsystem is installed. No changes are required to the default configuration settings to support the EMP.

If you have more than one EMP, you must set up the EMP LUNs as described in the next section.

You can control the following functions for EMPs:

- EMP LUN (see page 57)
- Additional EMP setting (see page 58):
  - Polling interval

6.2.1 Setting the EMP LUN

If you have only one EMP, the configuration settings are automatically enabled when the Galaxy 65 Subsystem is installed.

If you have more than one EMP, you must set up the EMP LUNs as described in this section.

The Galaxy 65 Subsystem allows in-band access to the EMP in the disk enclosure under the Galaxy 65 Subsystem’s target ID using direct EMP commands. You can set an EMP LUN to any value between 0 and 63, except where it would conflict with a previously assigned LUN (EMP, partition, or management).

You can also set it to NONE, which tells the Galaxy 65 Subsystem not to present a LUN for this EMP under the Galaxy 65 Subsystem's target ID.

You can set LUNs for EMPs that you plan to add by assigning a LUN to the EMP ID you want to use. The Galaxy 65 Subsystem assigns EMP IDs sequentially each time it starts.

Note EMP LUN settings have no effect on the CAPI interface, which always allows communication with all of the EMPs connected to the Galaxy 65 Subsystem.

You may want to change the EMP LUN if it conflicts with the LUN of another device.

To change the EMP LUN:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Enclosure Management**.

   The *Enclosure Management* page displays. The Set Galaxy 65 EMP LUNs panels display the current LUN for each EMP. Each EMP has an EMP number that the Galaxy 65 Subsystem assigns sequentially whenever it starts.

2. Select the LUN you want for each EMP.

3. Click **Update EMP Configuration**.

6.2.2 Changing the Additional EMP Setting

You can change four additional EMP settings:

- **EMP Polling Rate**: This is the interval, in seconds, that the Galaxy 65 Subsystem polls the EMPs for status changes. If the polling rate is set to zero, the Galaxy 65 Subsystem does not communicate with the EMP. Only use this setting if you suspect you are having communication problems with the EMP. The default setting is five seconds.

To change the EMP setting:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Enclosure Management**. The *Enclosure Management* page displays.

2. In the Enclosure Management Processor General Settings panel, select **EMP Polling Rate**.

3. Click **Update EMP Configuration**

Chapter 7

Troubleshooting and Problem Solving

7.1 Overview

The Galaxy 65 Enclosure includes a processor and associated monitoring and control logic to enable it to diagnose problems within the enclosure's power, cooling and drive systems.

The Enclosure Services Processor is housed along with the Ops Panel in the rear of the enclosure.

The sensors for power and cooling conditions are housed within the Power Supply/Cooling modules. There is independent monitoring for each unit.

If a fault is indicated on the Ops Panel, please refer firstly to Table 7–2 and then to the section referenced within that table.

7.1.1 Initial Start-up Problems

7.1.1.1 Faulty Cords

First check that you have wired up the Subsystem correctly. Then, if:

- cords are missing or damaged
- plugs are incorrect
- cords are too short

Call your supplier for a replacement.

7.1.1.2 Alarm Sounds On Power Up

Please refer to Section 7.3.

7.1.1.3 Green "Signal Good" LED on LRC Not Lit

Check that the Rx and Tx cables have not been inverted during installation.

7.1.1.4 Computer Doesn't Recognize the Galaxy 65 Subsystem

1 Check that the FC-AL interface cables from the Galaxy 65 enclosure to the host computer are fitted correctly.

2 Check the Drive Select ID settings on your Galaxy 65 Subsystem and on your system host.

3 Check that the LEDs on all installed drive carrier modules are illuminated Green. Note that the drive LEDs will not be lit during drive spinup.

4 Check that all drive carrier modules have been correctly installed.

5 Check that there is a valid FC-AL signal present at the I/O connector. If there is no signal present check that the cable has not been inverted during installation.

6 Check the I/O module setup as follows:
   - Check that the I/O module has been correctly installed and all external links and cables are securely fitted.
   - Check the maximum cable length has not been exceeded.

7.2 LEDs

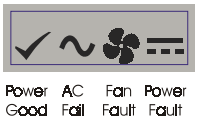
Green LEDs are always used for good or positive indication, flashing Green/Amber if non-critical conditions exist. Amber LEDs indicate there is a critical fault present within the module.

7.2.1 Power Supply/Cooling Module

The Power Supply Cooling LEDs are shown in Table 7–1.

- Under Normal conditions the LEDs should all be illuminated constant GREEN
- If a problem is detected the color of the relevant LED will change to AMBER.

Table 7–1 PSU LEDs



PSU Good	Green
AC input Fail	Amber
Fan Fault	Amber
DC Output Fail	Amber

7.2.2 Ops Panel

The Ops Panel displays the aggregated status of all the modules. The Ops Panel LEDs are shown in Figure 7–1 and defined in Table 7–2.

For details on how to remove and replace a module see Section 7.12.

Warning **Whenever replacing a module NEVER leave an EMPTY space in the rear of the enclosure, obtain a replacement before removing the problem part.**

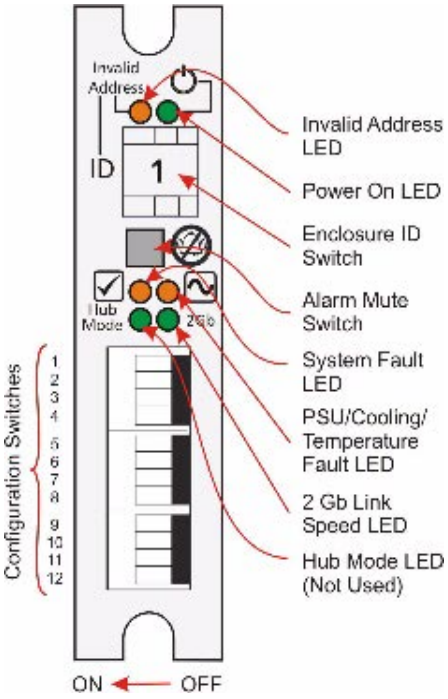


Figure 7–1 Ops Panel

7.3 Audible Alarm

The Ops Panel also includes an Audible Alarm which indicates when a fault state is present. The following conditions will activate the Audible Alarm:

- Drive Fault
- Fan Fault
- Voltage out of range
- Over temperature
- Thermal overrun
- System fault

7.3.1 Audible Alarm Mute

When the Audible Alarm sounds, it may be muted by pressing the Alarm Mute push-button. Automatic muting will take place after two minutes if the mute switch is not manually operated. The Alarm Mute push-button is located above the indicators on the Ops Panel (see Figure 7–1).

When the alarm is muted it will continue to sound with short intermittent bleeps to indicate that a problem still exists, It will be silenced when all problems are cleared.

LED Test Mode

The Alarm Mute push-button can also be used to test the LEDs on the Ops Panel. When the Mute push-button is held, all LEDs will be illuminated if there are no faults present.

7.4 Troubleshooting

The following sections describe common problems, with possible solutions, which can occur with your Galaxy 65 system

Table 7–2 Ops Panel LED States

Ops Panel LEDs						Other Associated LEDs or Alarm	State Description
Power (Green)	**PSU/ Cooling/ Temp (Amber)**	**System (Amber)**	**Address Mode Error (Amber)**	**FC-Galaxy 65 Loop Speed**	**Hub Mode Selected**		
On	Off	Off	Off	Off	Off		5V Aux present, overall power failed
On	***On***	***On***	***On***	***On***	***On***	single beep, then double beep	Ops Panel power On (5s) test state
On	Off	Off	Off				Power On, all functions good
On	***On***	Off				***PSU LEDs or Fan LEDs***	Any PSU fault or Fan fault
On	***On***	***Flash***					Over or Under temperature
On	Off	***On***				***ESI LED on LRC***	ESI processor A Failed
On	Off	***On***				***ESI LED on LRC***	ESI processor B Failed
On	Off	***On***				None	• Unknown (invalid or mixed) LRC module type installed, or • I2C Bus Failure (inter ESI processor), or • Backplane autostart watchdog failed.
On	***Flashing***	***Flashing***				PSU Removed	PSU removed and System power redundancy check option set. No indication if option not set.
On	Off	***Flashing***					No SES Drives fitted
On	***Flashing***	***On***				Intermittent audible alarm	Ops to ESI Communications failed
On			***Flashing***				Invalid address mode setting (change thumb wheel to valid ranges)
On				***On***			2Gb FC-Galaxy 65 Drive loop speed selected
On					***On***		RAID ONLY Host side

7.4.1 System Faults

Symptom	Cause	Action
1 The SYSTEM LED will illuminate AMBER on the LRC **2** Audible Alarm sound	The ESI processor has detected an internal fault (e.g. failure of an internal communications path)	**1** Check for other AMBER LED indications on the Power Supply/Cooling modules. If there is a PSU error present there may be a communications problem with that Power Supply/Cooling module. Remove and then re-fit the module, if the problem persists then change the module. **2** Check for other AMBER LED indications on the drives carriers. If none are evident then there may either be an ESI processor problem or a Backplane problem. **3** Change the Ops Panel module (see 7.12.2).

7.4.2 Power Supply/Cooling Faults

Symptom	Cause	Action
1 Ops Panel FAULTLED AMBER **2** An AMBER LED on one or more Power Supply/Cooling Modules. **3** Audible Alarm Sounding.	**1** Any power fault. **2** A fan failure. **3** A thermal condition which could cause PSU overheating.	**1** Check Power On/Off Switch on rear of Power Supply/Cooling module is switched ON.(not accessible on later models) **2** Check AC Mains Connections to Power Supply/ Cooling module is live. **3** Disconnect the Power Supply/Cooling module from mains power and remove the module from the system, Re-install: if problem persists, replace Power Supply/Cooling Module. **4** Reduce the ambient temperature.

7.4.3 Thermal Control

The Galaxy 65 Enclosure uses extensive thermal monitoring and takes a number of actions to ensure component temperatures are kept low and also to minimize acoustic noise.Air flow is from front to rear of the enclosure.

Symptom	Cause	Action
If the ambient air is cool (below 25 °C) and the fans are observed to increase in speed then some restriction on airflow may be causing additional internal temperature rise. **Note:** This is not a fault condition.	The first stage in the thermal control process is for the fans to automatically increase in speed when a thermal threshold is reached. This may be caused by higher ambient temperatures in the local environment and may be perfectly normal. **Note:** This threshold changes according to the number of drives and power supplies fitted.	**1** Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25mm at the front and 50mm at the rear is recommended. **2** Check for restrictions due to dust build-up, clean as appropriate. **3** Check for excessive re-circulation of heated air from rear to the front, use in a fully enclosed rack installation is not recommended. **4** Check that all Blank modules are in place. **5** Reduce the ambient temperature.

7.4.4 Thermal Alarm

Symptom	Cause	Action
1 Ops Panel FAULT LED AMBER. **2** An AMBER LED on one or more Power Supply/Cooling Modules. **3** Audible Alarm Sounding. **4** Air temperature exiting PSU above 55°C.	If the internal temperature measured in the airflow through the enclosure exceeds a pre-set threshold a thermal alarm will sound.	**1** Check local ambient environment temperature is below the upper 40°C specification. **2** Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25mm at the front and 50mm at the rear is recommended. **3** Check for restrictions due to dust build-up, clean as appropriate. **4** Check for excessive re-circulation of heated air from rear to the front, use in a fully enclosed rack installation is not recommended. **5** If possible shutdown the enclosure and investigate the problem before continuing.

7.5 Drive Carrier Module Faults

Disk drive status is monitored by a Green LED and an Amber LED mounted on the front of each Drive Carrier Module, providing the following indications:

Table 7–3 LED Functions

State	Green	Amber
No drive fitted	Off	Off
Drive Power ON	On	Off
Drive Activity	Blink off	Off
Drive Fault	On	On

Drive activity - LED may be off for a length of time during power up.

7.5.1 Dummy Carrier Modules

Dummy Carrier modules must be fitted to all unused drive bays to maintain a balanced air flow.

7.5.2 Auto Start Failure

Unless otherwise selected at installation time, all drives in the enclosure should automatically start their motors after power is applied. If this has not occurred there is a power problem (An alarm and power fault indication would normally be active).

Note The SYSTEM LED will flash Green/Amber.

7.6 Dealing with Hardware Faults

Ensure that you have obtained a replacement module of the same type *before* removing any faulty module.

Warning **If the Galaxy 65 Subsystem is powered up and you remove any module, replace it immediately. If the Subsystem is used with modules or module blanks missing for more than a few minutes, the Enclosure can overheat, causing power failure and data loss. Such use will invalidate the warranty.**

- Replace a faulty drive with a drive of the same type and capacity.
- All drive bays must be fitted with a Drive Carrier module or a dummy carrier module in order to maintain a balanced air flow.
- All the supplied plug-in power supply units, electronics modules and blank modules must be in place for the air to flow correctly around the cabinet.

7.7 Continuous Operation During Replacement

Depending on how the Subsystem is set up, if a disk unit fails, it can normally be replaced without interrupting the use of the system.

In addition, each enclosure contains two Power Supply/Cooling modules, either of which can maintain power and cooling to the Subsystem while the other is replaced.

7.8 Problems Accessing the Galaxy 65 Subsystem Using the Ethernet Port

Problem: You cannot access the Galaxy 65 Subsystem using the default IP address of 10.0.0.1.

Your distributor or another user may have changed the default IP address. Use the RS-232 connection to access the Galaxy 65 Subsystem and configure the IP address.

Problem: SAM pages do not display properly.

- Be sure that your system meets the system requirements described in the Galaxy 65 Subsystem Getting Started Guide.
- Configure your browser according to the information in the Galaxy 65 Subsystem Getting Started Guide.
- Click **Refresh** or **Reload** in your browser to display the most current SAM information.
- Be sure that someone else is not accessing the Galaxy 65 Subsystem using the menu-based interface or the Configuration Application Programming Interface (CAPI). It is possible for someone else to change the Galaxy 65 Subsystem's configuration using these other interfaces. The other person's changes may not display in SAM until you refresh the SAM page.
- If you are using Windows NT and Internet Explorer, make sure that the Ignore Colors option is not selected from **Tools > Internet Options > Accessibility**.

Problem: SAM page help is not displaying.
If you display page help for one page in SAM, do not close the page help window, and display page help for another SAM window, the page help window stays minimized. Either click the minimized window in the Windows task bar to display the latest help or close the page help window each time you finish using it.

7.9 Host Fibre Channel Problems

Problem: The host system does not see the Galaxy 65 Subsystem**.**

Verify in the **Monitor Galaxy 65 Subsystem > Status > FC Port Status** page (or in the Disk Array Administrator, the **CTRL-E** CFG Info screen) that the host channel FC World Wide Name is valid. Verify that the port ID is active and a valid arbitrated loop port address (AL_PA) is assigned. Verify the array LUN numbers are configured correctly and not overlapping.

Problem: The FC host port and switch or HBA do not establish a link.

When changing from Loop to Point to Point mode after already establishing a public loop connection, the switch may ignore subsequent attempts to perform point-to-point initialization. Take one of the following actions to establish the point to point connection:

- Physically disconnect and reconnect the FC cable.
- Configure the switch port to force point-to-point mode.
- Change the link speed for that port on the Galaxy 65 Subsystem and then change it back. The switch recognizes the change from loop to point to point due to the disruption caused when going to the other link speed (useful if Galaxy 65 Subsystem is being remotely managed). For information about setting up the host ports, refer to the Galaxy 65 Subsystem Getting Started Guide.
- Restart both SM modules. For information about restarting the SM modules, refer to the Galaxy 65 Subsystem Getting Started Guide.

7.10 Array Problems

Problem: Array is much smaller than it should be.
The backoff percent may be set higher than 1%, which is causing the array to be much smaller than the full size of its member disks.

Note We strongly recommend that you leave the backoff percent at 1%.

Setting the backoff percent “backs off” or reduces the capacity of the array by the given percentage. The backoff percentage helps when you assign spares by compensating for the minor capacity differences that occur between vendors. For example, two 18-GB drives from two different vendors may differ in capacity by 100 MB. With a backoff of 0%, you would not be able to replace an array member’s slightly larger 18-GB drive with a smaller 18-GB drive. If you intend to only use identical drives from the same vendor, you can use a backoff of 0%.

The default setting is 1% backoff. This default allows you to easily work with drives that have the same nominal capacity, but different actual capacities. The backoff percentage affects all arrays created on the Galaxy 65 Subsystem after you set the percentage.

If the drives in an array are not equal in size, the array capacity in a RAID 5 array is based on the smallest member’s capacity. The backoff percentage is then taken off the capacity from that amount.

7.10.1 Changing the Backoff Percent Using SAM

To change the backoff percentage:

1. From SAM, select **Manage Galaxy 65 Subsystem > General Config > Option Configuration**.
   The *Option Configuration* page displays.

2. Enter the Backoff Percent you want.

   Enter the percentage as three digits using the following format: 00.0%. The default is 01.0%.

7.10.2 Changing the Backoff Percent Using the Disk Array Administrator

A change to this setting on either SM module is automatically updated on the other SM module.

To change the backoff percentage:

1. From the System Menu, select **Configuration Menu** and press **Enter**.
   The *Configuration Menu* displays.

2. Select **Backoff Percent** and press **Enter**.
   The *Backoff Percent* screen displays.

3. Enter the Backoff Percent you want to use and press **Enter**.

   Enter the percentage as three digits using the following format: 00.0%. The default is 01.0%.

7.11 Galaxy 65 Subsystem Problems

Problem: The Storage Manager module's STATUS LED does not turn on.

Check that the SM module is properly seated in the slot and the handles are closed and locked. Check for events in SAM and the RS-232 interface (Disk Array Administrator) for power-on initialization and diagnostics errors.

Problem: The Galaxy 65 Subsystem reports an SDRAM memory error.

Contact your supplier.

7.12 Replacing a Module

Please refer to the Galaxy 65 Getting Started Manual (P/N 44521-01A) for information on the initial installation of the plug-in modules in the Galaxy 65 enclosure.

Warning **Observe all conventional ESD precautions when handling Galaxy 65 modules and components. Avoid contact with Backplane components and module connectors, etc.**

7.12.1 Power Supply/Cooling Modules

Warning **Do not remove covers from the power supply unit. Danger of electric shock inside. Return the PSU to your supplier for repair.**

7.12.1.1 Removing a PSU Module

Warning **Do not remove the faulty Power Supply/Cooling module unless you have a replacement unit of the correct type ready for insertion.**

If a power supply unit or its fan is faulty, you must replace the whole Power Supply/Cooling module.

As there should always be two power supply units installed, you can continue working while replacing the faulty module.

1. Make sure you identify the faulty Power Supply/Cooling module correctly, from the two modules installed,
2. Switch off and disconnect the power supply cord.
3. Squeeze the two latches on the PSU handle together (Figure 7–2) and open the handle to cam the PSU out of the enclosure (Figure 7–3).
4. Grip the handle and withdraw the PSU (Figure 7–4).

7.12.1.2 Inserting the Module

1. Check for damage, especially to the rear connector on the PSU.

Caution *Handle the module carefully and avoid damaging the connector pins. Do not install the module if any pins appear to be bent.*

2 With the PSU handle (Figure 7–3) in the open position, slide the module into the enclosure

3 Cam the module home by manually closing the PSU handle (see Figure 7–4). A click should be heard as the handle latches engage (see Figure 7–2).

4 Connect the power supply cord to the power source and switch the power supply ON.

Note The alarm will sound until the new Power Supply/Cooling module is operating correctly.

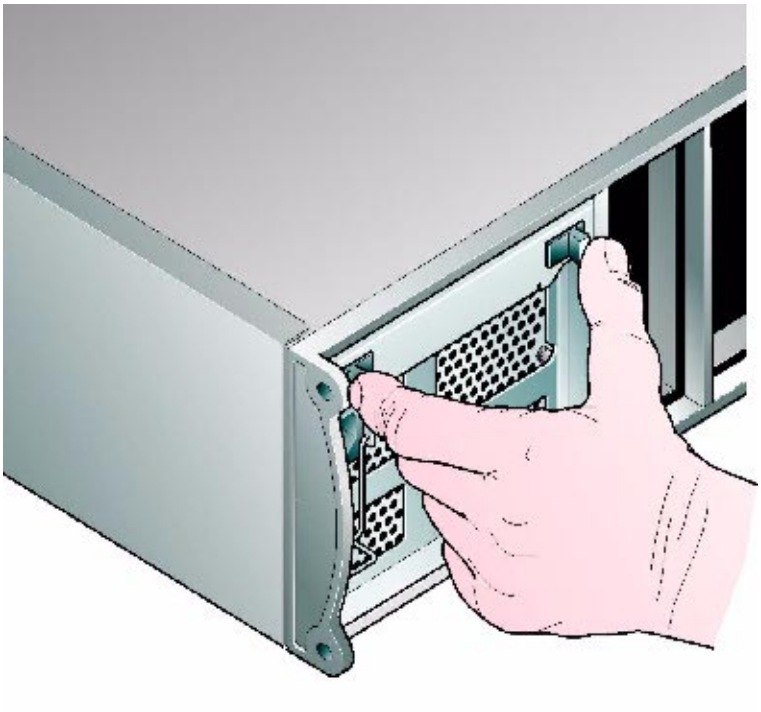


Figure 7–2 Removing/Inserting a Power Supply/Cooling Module (1)

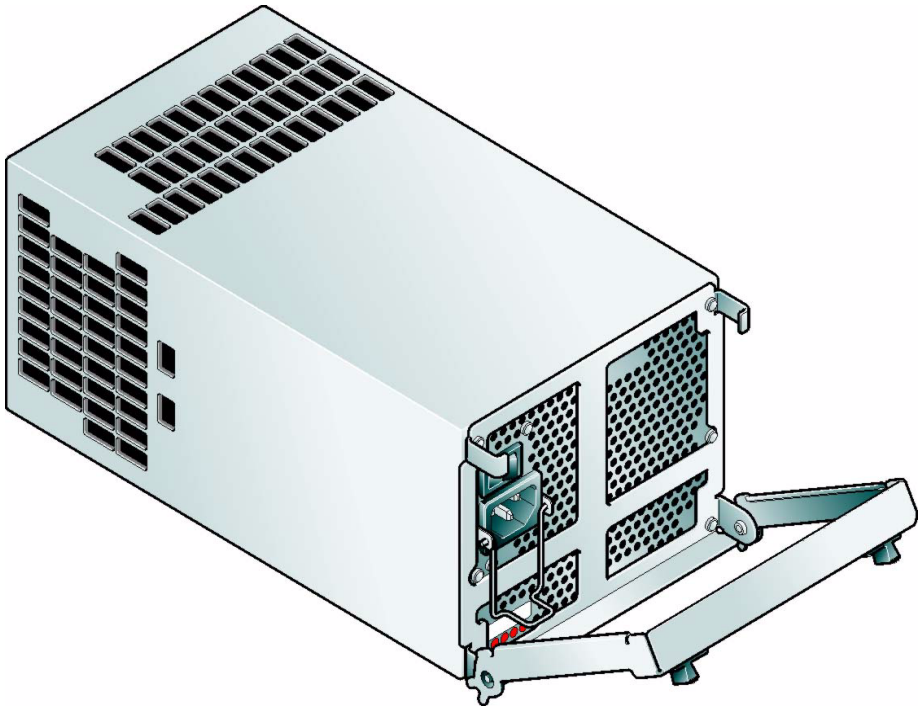


Figure 7–3 Removing a Power Supply/Cooling Module (2)

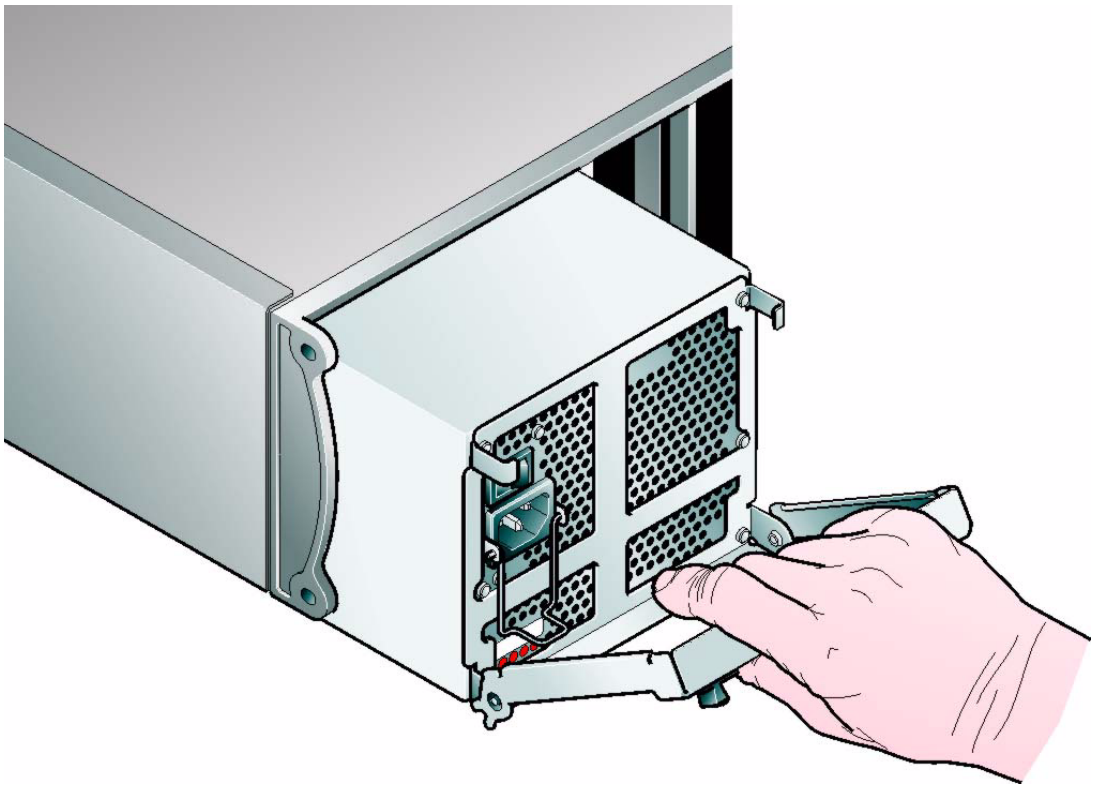


Figure 7–4 Removing a Power Supply/Cooling Module (3)

7.12.2 Ops Panel

The Ops Panel is an integral part of the enclosure chassis assembly and can only be replaced by trained personnel.

7.12.3 Storage Manager Module

Please refer to the Galaxy 65 Getting Started Manual (P/N 44521-01A) for full information on installing the Storage Manager module.

Important **Fitting of a RAID controller to the LRC module is a factory only operation.**

7.12.3.1 Removing the Module

Warning **Do not remove this module unless a replacement can be immediately added. The system must not be run without all modules in place.**

Note As there should always be two SM modules installed, you can continue working while replacing the faulty module.

1 Ensure that you correctly identify the faulty module from the two modules installed.

2 Using two hands, grasp each latch between the thumb and forefinger of each hand. Squeeze thumb and forefinger together to release the latch. Pull the latches forward to cam the module out of the enclosure (Figure 7–5).

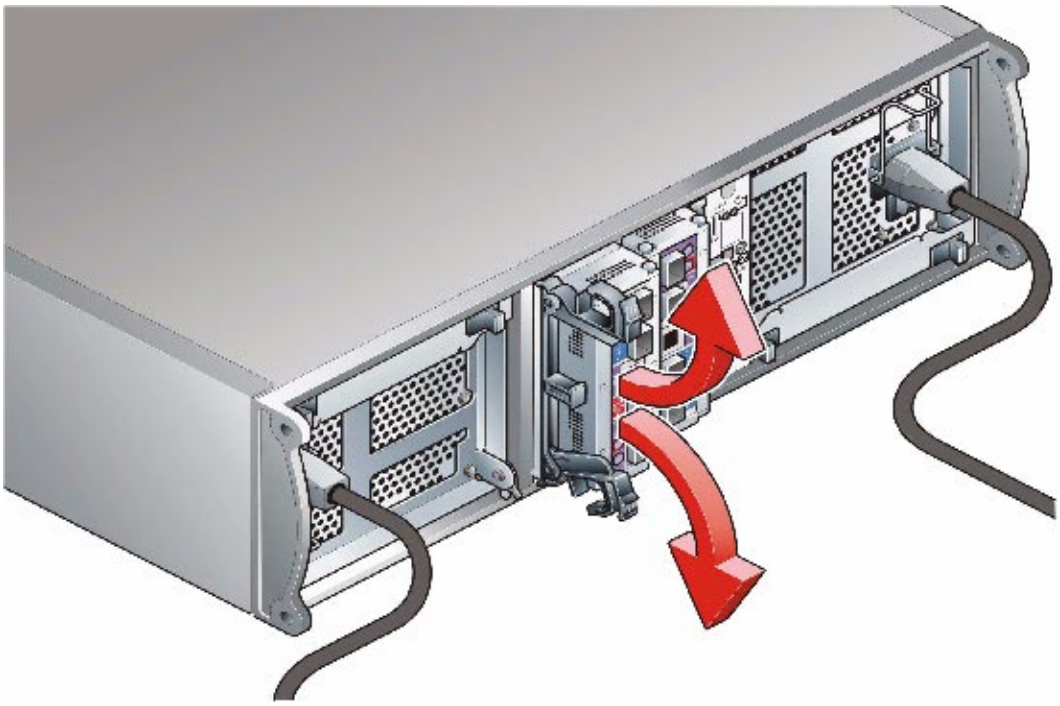


Figure 7–5 Removing a Storage Manager Module (1)

3 Grip the latch handles and withdraw the SM module (Figure 7–6).

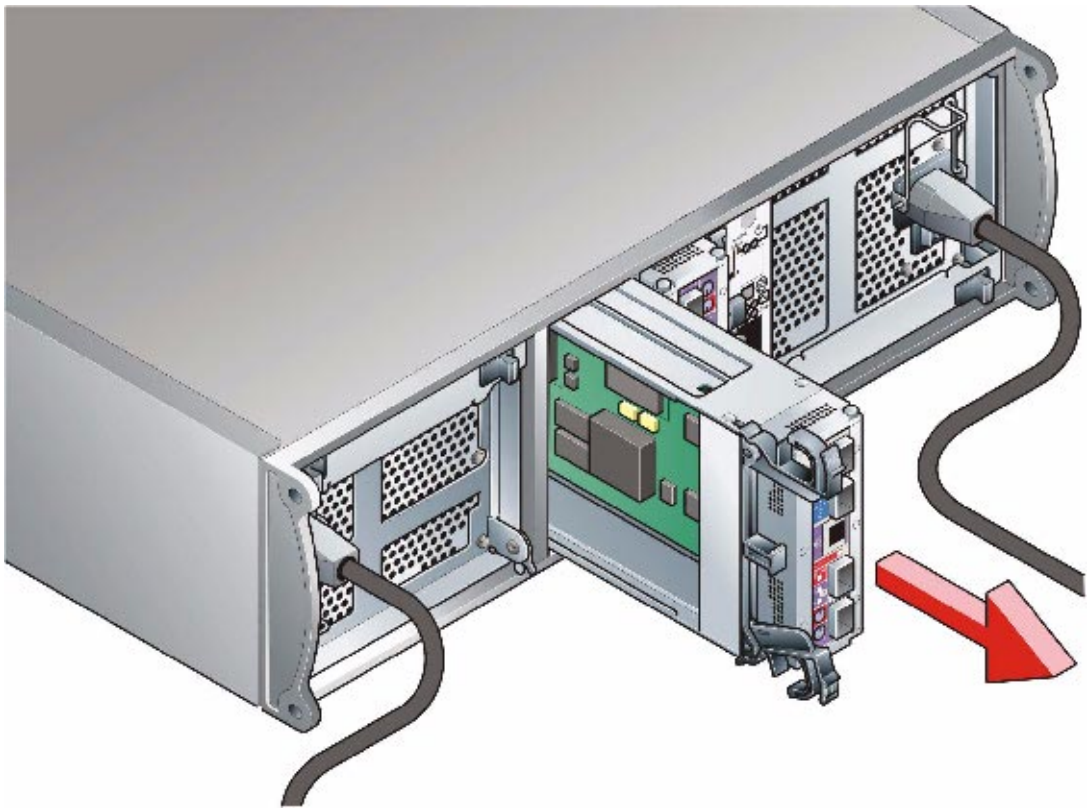


Figure 7–6 Removing a Storage Manager Module (2)

7.12.3.2 Inserting the Module

1. With the latch in the open position, slide the LRC module into the enclosure until the latch engages automatically.
2. Cam the module home by manually closing the latches (see Figure 7–7).
3. A click should be heard as the latch engages.

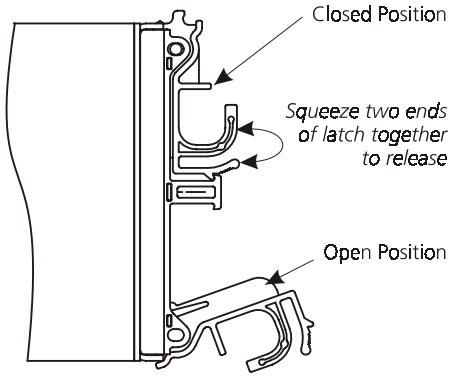


Figure 7–7 SM Module Latch Operation

7.12.4 Insertion/Removal of SFP Modules

The LRC Module is fitted with four Small Form Factor (SFP) GBIC modules. Replacement of these modules should be performed in accordance with the following procedure:

1 Press down firmly on the removal tab located at the bottom of the cable.

2 Remove the module by firmly gripping each side of it.

Caution *If the module cannot be easily removed do not use force. Repeat step 1.*

7.12.5 Battery Replacement

Battery Safety

- The battery should only be replaced by a trained technician.
- The battery should be disposed of in accordance with the manufacturer's instructions and National regulations.

Warning **Risk of explosion if battery assembly is replaced by an incorrect type. The battery assembly must only be replaced with a battery assembly of the following type, which contains current limiting and temperature sensing devices:**

- Battery Assembly SM
  Feature Code: Galaxy 65-Batt

Caution *If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

ESD Precautions

It is recommended that you fit and check a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling plug-in modules and components. Avoid contact with backplane components and module connectors, etc.

Data Security

Caution *This procedure will remove all data from the cache.*

Tools Required

None

Removal/Replacement Procedure

1 Unplug the battery flying lead from the RAID controller.

2 Release the battery assembly by squeezing the two latches (shown in Figure 7–8) with thumb and forefinger and slide the assembly out of the LRC module.

3 Fit the new battery assembly by squeezing the two latches and sliding it into the LRC module.

4 Release the two latches and reconnect the battery flying lead to the RAID controller.

5 Dispose of the battery in accordance with National safety regulations.

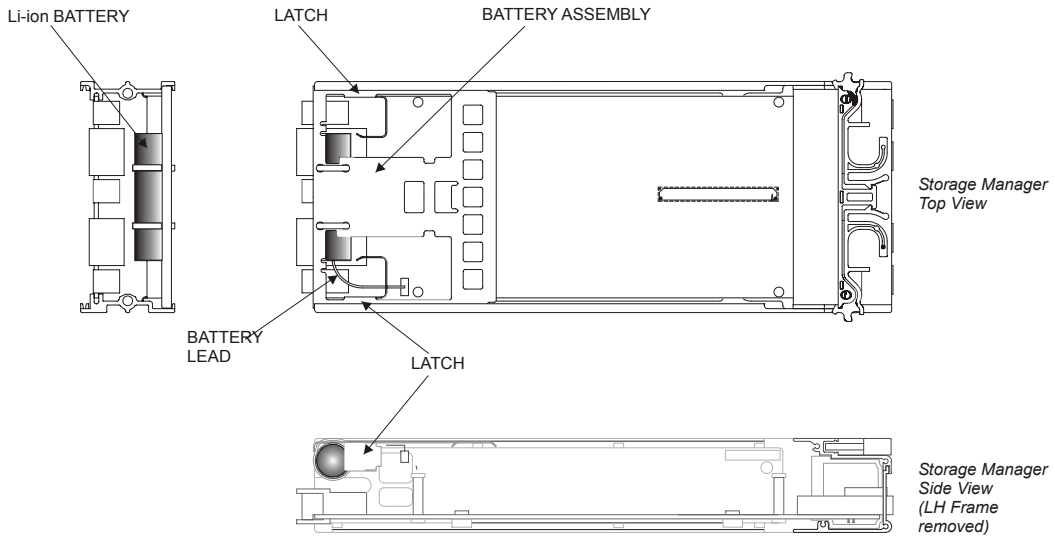


Figure 7–8 Storage Manager Module - Battery Assembly Location

7.12.6 Drive Carrier Module

Please see the Galaxy 65 Getting Started Manual (P/N 44521-01A) for information on the initial installation of the plug-in modules in the Galaxy 65 enclosure.

Warning **Observe all conventional ESD precautions when handling Galaxy 65 modules and components. Avoid contact with backplane components and module connectors, etc.**

7.12.6.1 Removal and Replacement

Caution ***Drive spin down***
*Damage can occur to a drive if it is removed while still spinning. If possible use the operating system to spindown the drives prior to removal. If this is not possible we recommend that you perform **All** steps of the following procedure to ensure that the drive has stopped prior to removal:*

1 Release the carrier handle, by pressing the latch in the handle towards the right

Note The anti-tamper lock must be off.

2 Gently withdraw the Drive Carrier module approximately1 inch (25mm) and wait 30 seconds.

3 Withdraw the module from the drive bay and fit a replacement module in accordance with the instructions in the Galaxy 65 Getting Started Manual (P/N 44521-01A).

7.13 Problems During Startup (When Using the Disk Array Administrator)

The following sections describe problems you might encounter when using the Disk Array Administrator during Power On Self-Test (POST) or during startup and explain how to resolve those problems. POST shows problems related to the processor, logic, and memory.

Problem: Galaxy 65 Subsystem failed the onboard memory test.

When this failure occurs, it means the internal CPU memory failed. Contact your supplier for a replacement.

Problem: System hangs at `Loading Bridge` during BFLU Loader Menu.

Update the software to ensure you are using the latest version. See section 5.13, ”Updating Software”, on page 51. If you cannot update the software or if the updated software does not correct the problem, replace the SM.

Problem: One of the POST diagnostic tests failed.

Contact your supplier.

Problem: The system hangs at `CT_srv starting`.

Follow these steps to resolve the problem:

1 Check the disk and host ports to make sure they are properly connected.

2 Check the enclosure to make sure everything is properly connected.

7.14 Terminal Emulator and COM Port Problems

Problem: Screen continuously puts out garbage characters.

The likely cause of this problem is a baud rate mismatch between the terminal emulator and the Galaxy 65 Subsystem. The default baud rate is 115,200. Follow these steps if you set your terminal emulator to this rate and still get garbage characters:

1 If you are able, shut down both SMs.

For information about restarting the SMs, refer to the Galaxy 65 Subsystem Getting Started Guide. If you are unable to shut down the Galaxy 65 Subsystem, continue with step 2.

2 Turn off the power on both Power Supply/Cooling modules.

3 Press and hold down the spacebar of your terminal emulator.

4 Turn on the power while continuing to press the spacebar. This will allow the Galaxy 65 Subsystem to auto-detect the baud rate setting.

5 When the Flash Utility appears, select option **5** to continue to start the SM.

Note Some terminal emulators do not immediately change to the new baud rate settings, and you have to exit and restart the emulator to use the new settings.

Problem: Nothing is displayed on the terminal emulator screen.

The probable cause of this problem is a bad RS-232 cable connection or swapped transmit/receive lines. If the cable is properly connected on both ends, try a *null modem* adapter that will reverse the RS-232 transmit and receive signals. The need for a null modem adapter depends on the RS-232 cable you are using.

Problem: The Galaxy 65's STATUS LED is on, but there is no RS-232 display.

Check that the RS-232 cable is the correct type (straight-through). Check that the terminal emulation utility on the computer system is properly configured. See Appendix B section B.2.2, "Accessing the Disk Array Software Using the Ethernet Port", on page 99.

Problem: Screen is updated, but will not respond to keystrokes.

Be sure you are using a straight-through serial cable or try using a null modem adapter. Disable hardware flow control on the terminal or terminal emulator. The Galaxy 65 Subsystem supports XON/XOFF flow control and works properly in most cases with no flow control.

Problem: Screen looks correct, but clock is not being updated.

Check to be sure that the Galaxy 65 Subsystem is still powered on. If you are using XON/XOFF, press the **CTRL** key and **Q** key simultaneously to start data flowing.

Problem: Screen is updated and menus appear correctly, but boxes around menus look incorrect.

Try a different font in your terminal emulator program, such as Terminal. If you cannot find a font that looks correct, set ASCII Display to **Yes** in the Display options item of the Configuration Menu.

7.15 Warning and Error Events

There are a number of conditions that trigger warning or error events, activate the alarm, and may affect the state of the STATUS and FAULT LEDs. The alarm or buzzer sounds mainly when SAM or the Disk Array Administrator displays a warning or error event.

The alarm will silence when you press the Mute button on the Galaxy 65, mute the alarm in SAM (refer to the Galaxy 65 Subsystem Getting Started Guide) or acknowledge the event by pressing **Esc** in the Disk Array Administrator. The events in these categories are listed below.

7.15.1 Warnings

Warning events let you know that something related to the Galaxy 65 Subsystem or an array has a problem. You should correct the problem as soon as possible. Table 7–4 defines each warning event and recommends the action you should take.

Table 7–4 Warning events

Event	Definition	Recommended Action
ARRAY CRITICAL	One or more drives are down and the array is online, but is no longer fault tolerant.	Add a spare to the array or the spare pool. Then replace the bad drives. Refer to the *Galaxy 65 Subsystem Getting Started Guide*.
ARRAY OFFLINE	More than one drive in a RAID 0 or volume set went down bringing the array to an offline state. This array is no longer accessible by the host.	Replace the bad drive and restore the data from backup.
BATT FAIL INFO	A warning condition in the battery pack or charging interface has been detected.	Replace the battery, see section 7.12.5 on page 74.
BOOT ONLINE FAIL	During startup, the system attempted to put the specified module online. This operation failed.	The event gives a reason why the Put Online failed. Examine this reason and take the appropriate action. If the reason is DIAGNOSTIC FAIL, a hardware problem was found with the module. In this case, try replacing the module with a different one.
DISK CHAN DEGRAD	Errors detected on one of the disk channels have caused the Galaxy 65 Subsystem to mark the channel as degraded.	Determine the source of the errors on the specified disk channel and replace the faulty hardware.
DRIVE DOWN	An error occurred with the drive and it was downed, removing it from the active array.	Add a spare to the array or the spare pool. Then replace the bad drive. Refer to the *Galaxy 65 Subsystem Getting Started Guide*.
HW STATUS CHANGE	A SM has detected a significant change in the status of one of the power modules.	If the event indicates that the module has failed or is not present, install a new module.

Table 7–4 Warning events (Continued)

Event	Definition	Recommended Action
OTHER WWN UNKNOWN	The host Fibre Channel World Wide Names (node and port) previously presented by the other SM module (which is currently offline) in this system are unknown. This event has two possible causes: The online SM module reporting the event was replaced or moved while the system was powered off. The online SM module had its flash configuration cleared (this is where the previously used WWNs are stored).	The online Storage Manager module recovers from this situation by fabricating a WWN for the other SM module based on its own serial number. If you see this event, then you need to verify the WWN information for the other SM module on all hosts that access it.
PREV WWN UNKNOWN	The host Fibre Channel World Wide Names (node and port) previously presented by this Storage Manager module in this system are unknown. This event has two possible causes: • One or both SM modules in a have been replaced or moved while the system was powered off. • One or both SM modules have had their flash configuration cleared (this is where the previously used WWNs are stored).	This SM module recovers from this situation by using WWNs based on its own serial number. If you see this event, then you need to verify the WWN information for this SM module on all hosts that access it.
REPLACE BATTERY	The battery is approaching its four-year life span.	Replace the battery, see section 7.12.5 on page 74.
SDRAM CORR ECC	A correctable single-bit cache memory ECC error occurred.	Contact your Supplier.
SPARE UNUSABLE	The drive still contains metadata that must be cleared.	Clear the metadata from the spare drive. See F.1.2, ”Clearing Metadata from a Drive”, on page 177.
SMART EVENT	A disk drive informational exceptions page control (IEPC) predictive failure message was received. No actions by the Galaxy 65 Subsystem are taken on the drive for these events.	Run diagnostics available from your operating system on the affected drive. Replace the drive, if necessary.

Table 7–4 Warning events (Continued)

Event	Definition	Recommended Action
SYS OFFLINE FAIL	The system attempted to use Put Offline on an SM, but the request was rejected, probably because availability to the hosts would have been affected.	This Put Offline request may occur when you press one of the module latches to remove the module. In this case, we recommend that you do not take the module offline.
SYS ONLINE FAIL	The system attempted to Put Online a newly inserted module, however the Put Online request failed.	The event gives a reason why the Put Online failed. Examine this reason and take the appropriate action. If the reason is DIAGNOSTIC FAIL, a hardware problem was found with the module. In this case, try replacing the module with a different one.
UNWRITABLE CACHE	The SDRAM cache has battery backed-up data, and the arrays assigned to this data are not present.	Either determine which drives are missing and reinstall them, or select **Yes** when asked if you want to discard this data.
VOLT/TEMP WARN	The analog-to-digital convertor monitored a temperature or voltage in the warning range.	Check that the Galaxy 65 Subsystem's fans are running. Check that the ambient temperature is not too warm. Check for any obstructions to the air flow. See , "Array Basics", on page 89.

7.15.2 Errors

Error events let you know that something related to the Galaxy 65 Subsystem, module, or disk drives has failed and requires immediate attention. Table 7–5 defines each error event and recommends the action you should take.

Table 7–5 Error events

Event	Definition	Recommended Action
ARRAY CRITICAL	One drive in the specified array failed and the array is running in degraded mode (not fault tolerant).	Replace the failed drive and add it as a spare to the critical array. If you have dynamic spares enabled, you only need to replace the drive. The system will automatically reconstruct the array.
BATTERY FAILED	A failure in the battery pack or charging interface has been detected.	Check that the battery is firmly connected to the SM module. Refer to the *Galaxy 65 Subsystem Getting Started Guide*. Replace the battery.
DISK CHAN FAILED	An error has occurred in communicating on the disk channel.	Check the cables on the channel.

Table 7–5 Error events (Continued)

Event	Definition	Recommended Action
SDRAM UNCORR ECC	A non correctable multiple-bit cache memory ECC error occurred.	Contact your Supplier.
VOLT/TEMP FAIL	The analog-to-digital convertor monitored a temperature or voltage in the failure range.	Check that the Galaxy 65 Subsystem's fans are running. Check that the ambient temperature is not greater than 40°C. If the Power Supply/Cooling modules have no errors, replace the SM module where the error occurred.

7.16 Setting Up and Viewing the Debug Log

You can set up additional logging when instructed by Rorke's technical support personnel.

7.16.1 Summary of Debug Log Capabilities

- **Single controller debug information:** available from the Disk Array Administrator via the serial port on each controller module. Because of the direct connection of the serial port to a storage controller, debug information from this port can sometimes provide information unavailable from the Ethernet port, but this information will only be from one storage controller of the redundant storage controller pair. This information is available as long as one individual controller can boot, read its flash memory and communicate with it's serial port.

- **Combined log debug information:** available through the SAM via the Ethernet port on each controller module.

  This set of logs will have several advantages over the single controller logs, but will also have a limitation in that collecting all the log data and passing it out via the Ethernet port requires a greater amount of hardware/software to be operational than for the single controller serial port case. Therefore, in some product failure scenarios the combined logs will potentiality have some holes in the debug data and it will also be necessary to review the single controller logs.

  Use the following procedure to collect all three logs:

7.16.2 Collecting Debug Logs

For most problem scenarios you should collect ***three*** logs, a combined log from one of the two SAM Ethernet port connections and a single controller log from each of the two Disk Array Administrator local serial port connections.

Note If one of the redundant controllers is down we recommend that you restart that Storage Manager module, if possible, before collecting the debug logs.

7.16.2.1 SAM: Manage/Utilities/Debug Utilities/Save Debug Logs/Save Log Files

1 You may optionally enter contact information, which will be included in the log information file. By doing so, your contact information and comments will help create a unique document that may be used to identify the issue and origin when these logs are being collected for diagnostic purposes.

2 Make checkbox selections for the logs you want to collect:
- *Device status summary* - basic status and configuration information for the device.
- *Event logs* - event logs from both controllers when in active-active mode.
- *Diagnostic debug logs* - debug logs from both controllers when in active-active mode.
- *Boot logs* - startup sequence for each storage controller.
- *Critical error logs* - up to 4 critical error dumps from each controller. these will not exist if no critical errors have occurred.
- *CAPI trace* - interface activity between the controller's internal processors.

3 Click on **Generate Debug Logs** - this operation can take up to several minutes, depending on the logs selected."

4 Click on **Download Selected Logs To File** - to use your browser's file save capabilities to save the log in the location you prefer.

5 Name the file - to include date. bug number or problem name and some indication that this is a combined log, e.g. 20030113_bug#123_Combined.logs.

7.16.2.2 Disk Array Administrator on Controller A: Utilities Menu

1 Start a **data capture** session on your terminal emulator program (in Hyperterm this is the **Transfer/ Capture Menu** drop-down menu selection.

2 Name the file - to include date. bug number or problem name and SM-A or -B, e.g. 20030113_bug#123_SM-A.txt.

3 Select **Dump Debug Info** from the utilities menu of Disk Array Administrator.

4 Allow the data dump to complete.

5 Stop the **data capture** session on your terminal emulator program.

7.16.2.3 Disk Array Administrator on Controller B: Utilities Menu

1 Repeat the procedure in section 7.16.2.2 for the second controller.

7.16.3 Configuring Debug Logs

If you are advised by your supplier to modify the or most log collection scenarios, you should utilize the debug log setup that is the default on the RAID system when it is shipped to you. If you are advised by your supplier to modify the debug log setup, carry out the following procedure:

1 Follow the steps in section 7.16.2.1 on page 82.

2 Select the Debug Configuration options as advised by your supplier.

7.16.4 Using SAM to Set Up and View the Debug Log

You can select additional events, which are not normally logged, for the debug log. Under normal conditions, you should not have any of the events selected. The additional events have a slight effect on read and write performance.

You can also save the debug log to a file. For more information, see section 4.3, ”Saving Log Information to a File”, on page 35.

To set up the debug log:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > Debug Log Configuration**.
   The *Debug Log Configuration* page displays.
   Select each additional event you want in the debug log.
2. Click **Change Debug Configuration**.

To view the debug log:

1. From SAM, select **Manage Galaxy 65 Subsystem > Utilities > View Debug Log**.
   The *View Debug Log* page displays.
2. Select the viewing options you want.
3. Click **Load/Reload Debug Log**.

7.16.5 Using the Disk Array Administrator to Set Up Debug Logging

You can view a debug log by pressing **Ctrl-E**. Pressing **Ctrl-E** toggles you through the event log, debug log, hardware information, and configuration information screens.

To set up debug logging:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The *Utilities Menu* displays.

1. Select **Debug Log Enable** and press **Enter**.
   The *Debug Log Enable* screen displays.
2. Select each logging item that you want to turn on and press **Enter**.
3. Select **Save Changes** and press **Enter**.

7.17 Using the Loader Diagnostics Menu

If you have any diagnostic errors, contact Rorke technical support.

7.18 Using the Loader Utility Menu

If you have any diagnostic errors, contact Rorke technical support.

7.19 Understanding Disk-related Errors

The event log includes errors reported by EMPs and disk drives on your system. If you see these errors in the event log, the information below may assist you. For more information about viewing the event log, refer to the *Galaxy 65 Subsystem Getting Started Guide*.

7.19.1 Disk Errors

If a disk detects an error, it reports the error, which is recorded in the event log. Table 7–6 lists some of the most common SCSI sense key descriptions (in hexadecimal). Table 7–7 lists the descriptions for the most common sense codes (ASC) and sense code qualifiers (ASCQ), all in hexadecimal. Refer to the *SCSI Primary Commands - 2 (SPC-2) Specification* for a complete list of ASC and ASCQ descriptions.

Table 7–6 Common sense key descriptions

Sense Key	Description
0h	No sense
1h	Recovered error
2h	Not ready
3h	Medium error
4h	Hardware error
5h	Illegal request
6h	Unit attention
7h	Data protect
8h	Blank check
9h	Vendor-specific
Ah	Copy aborted
Bh	Aborted command
Ch	Obsolete
Dh	Volume overflow
Eh	Miscompare
Fh	Reserved

Table 7–7 ?Common ASC and ASCQ descriptions

ASC	ASCQ	Descriptions
0C	02	Write error—auto-reallocation failed
0C	03	Write error—recommend reassignment
11	00	Unrecovered read error
11	01	Read retries exhausted
11	02	Error too long to correct
11	03	Multiple read errors
11	04	Unrecovered read error—auto-reallocation failed
11	0B	Unrecovered read error—recommend reassignment
11	0C	Unrecovered read error—recommend rewrite the data
47	00/01	FC CRC error
48	00	Initiator-detected error message received

7.19.2 Disk Channel Errors

Disk channel errors are similar to disk-detected errors, except they are detected by the Galaxy 65 Subsystem, instead of the disk drive. Some disk channel errors are displayed as text strings, others are displayed as hexadecimal codes.

Table 7–8 lists the error code descriptions. Most disk channel errors are informational because the Galaxy 65 Subsystem issues retries to correct any problem. Errors that cannot be corrected with retries will result in another critical event describing the affected array (if any).

Table 7–8 Disk channel error codes

Error Code	Description
Abort LkDn	I/O request was aborted because of third-party loop initialization procedure (LIP).
CRC Error	CRC error on data was received from a target.
Dev Busy	Target reported busy status.
Dn/Ov Run	Data overrun or underrun has been detected.
IOTimeout	Galaxy 65 Subsystem aborted an I/O request to this target because it timed out.
Link Down	Link down while communication in progress.
LIP	I/O request was aborted because of a channel reset.
No Respon	No response from target.
Port Fail	Disk channel hardware failure. This may be the result of bad cabling.

Table 7–8 Disk channel error codes (Continued)

Error Code	Description
PrtcolError	Galaxy 65 Subsystem detected an unrecoverable protocol error on the part of the target.
QueueFull	Target reported queue full status.
Stat: 04	Data overrun or underrun occurred while getting sense data.
Stat: 05	Request for sense data failed.
Stat: 32	Target has been reserved by another initiator.
Stat: 42	I/O request was aborted because of Galaxy 65 Subsystem's decision to reset the channel.
Stat: 44	Galaxy 65 Subsystem decided to abort I/O request for reasons other than bus or target reset.
Stat: 45	I/O request was aborted because of target reset requested by Galaxy 65 Subsystem.
Stat: 46	Target did not respond properly to abort sequence.

7.19.3 Voltage and Temperature Errors and Warnings

Most voltage and temperature errors and warnings relate to the Power Supply/Cooling modules. Check the following to resolve these errors or warnings:

1. Check that all of the fans are working by making sure all of the Galaxy 65 Subsystem's LEDs are green or using the SAM status pages.
2. Make sure that all the Galaxy 65 Subsystem modules are properly seated in their slots and that their handles are locked.
3. Make sure that no slots are left open for more than two minutes.

   If you need to replace a module, leave the old module in place until you have the replacement or use a blank cover to close the slot. Leaving a slot open negatively affects the airflow and may cause the unit to overheat.
4. Try replacing each Power Supply/Cooling module, one at a time.
5. Replace the SM modules, one at a time.

7.20 Slow Write Performance

This can be caused by powering down the enclosure without first shutting down the controllers.

- The battery must be greater than 90% charged for write back cache to be enabled.

7.21 Spare Parts and Ancillary Items

The following replaceable parts are available for the Galaxy 65 Subsystem:

- Chassis (including Backplane)
- AC Power Supply/Cooling Module
- Drive Carrier Module
- Storage Manager Module
- External FC-AL Signal Cables
- Cables
  - LC - LC optical cable
  - LC - SC optical cable
  - SFP - SFP copper patch cable (1 M length)
  - HSSDC2 - HSSDC1
  - HSSDC2 - DB9
  - HSSDC2 - HSSDC2
  - RS232 cable
  - LAN cable
- 19 inch rack mounting rail kit
- Dummy Carrier Module
- Blank SM Module
- SFP module, optical
- SFP module, copper
- Battery, Li-ion
- (Country specific) power cords
- Bifurcated power cords
- Keys for Drive Carrier modules.
- All documentation

7.22 Upgrading Your LRC I/O Modules

You can upgrade your existing JBOD or RAID LRC module to a Rorke Data Galaxy 65 RAID LRC module in accordance with the following procedure:

Caution *Ensure that your Power Supply/Cooling modules are marked with P/N 44191-XX. If they are not you will need to upgrade your PSUs. Please contact your supplier and request the upgrade modules.*

1 Change the Ops Panel switch settings to those shown in Table 7–9.

Important **Switch settings are only read at Power On.**

The Galaxy 65 enclosure ID must always be set to select ID1.

2 Remove the existing LRC modules in accordance with the procedure in 7.12.3.1, ”Removing the Module”, on page 72.

3 Install the Storage Manager modules in accordance with the procedure in 7.12.3.2, ”Inserting the Module”, on page 73.

Table 7–9 Ops Panel Switch Functions *(Default settings for Galaxy 65 LRC usage at 2Gb/s)*

Switch Number	Function	Recommended Setting		Definition
1	Loop Select, Dual (2x8)	Off		LRC operates on two loops of 8 drives Mandatory
2	Not Used	Note: on Galaxy 65-FC2 enclosures this must be set On.		
3	Not Used			
4	Not Used			
5 & 6	Not Used			
7 & 8	Drive Loop Speed Select	*Sw7*	*Sw8*	
		On	Off	Force 2Gb/s
		Off	Off	Force 1Gb/s
9 & 10	Drive Addressing Mode Selection	*Sw9*	*Sw10*	
		On	Off	Mode 2, 2x8 mode. Mandatory
11	SOFT SELECT	On		Select Functions using the hardware switches
12	Not Used			

Caution *All mandatory settings must be observed in order for the Galaxy 65 system to function correctly.*

Note To set Host 1Gb use the Ethernet connected configurator.

Appendix A

Array Basics

Galaxy 65 RAID controllers let you set up and manage disk arrays. A *disk array* (array) is a group of disks that appears to the system as a single virtual disk. This is accomplished through software resident in the RAID controller. *RAID* (Redundant Array of Independent Disks) refers to disk arrays in which part of the array storage capacity may be used to store redundant information. The redundant information lets you restore user data if a disk in the array fails.

The host system views the Galaxy 65 Subsystem as a single FC disk drive. It is actually an array of physical disks behind a RAID controller. The Galaxy 65 Subsystem is managed by software to appear as a single, very large physical disk. Depending on the array type, the virtual disk has advantages in fault-tolerance, cost, performance, or a combination of these. This section explains the different array types and the disk requirements for each type.

Tip: Choosing the right RAID level for your needs will improve performance. The following are examples of storage needs and appropriate RAID level. Rorke Data RAID controllers also provide methods of tracking statistical data to aid in the process.

Table 1–1 shows some example applications and RAID levels.

Table 1–1 Example applications and RAID levels

Application	**RAID level**
Testing multiple operating systems or software development (where redundancy is not an issue)	Volume
Fast temporary storage or scratch disks for graphics, page layout, and image rendering	RAID 0
Workgroup servers	RAID 1, 10
Video editing and production	RAID 3 or 4
Network operating system, databases, high availability applications, workgroup servers	RAID 5
Very large databases, Web server, video on demand	RAID 50

A.1 Array Types

Array types are defined by their RAID level, a number from 0 through 5 (a higher RAID level does not necessarily indicate a higher level of performance or fault tolerance). Rorke Data RAID controllers let you create the types of arrays that have proven to be the most useful for RAID applications: RAID 0, 1, 10 (also known as mirrored), 3, 4, 5, 50, and volume sets.

For more detailed information about array types, refer to *The RAID Book: A Storage System Technology Handbook* by Paul Massiglia, ISBN 1-879936-90-9 or their web site at www.raid-advisory.com.

A.1.1 RAID 0 (Striped Disks)

In a RAID 0 array, data is distributed, or *striped*, across the disks in the array. The array appears to the server as one large disk with a capacity approximately equal to the combined capacity of the physical disks. Because multiple reads and writes can be handled in parallel, the I/O performance of the array is much better than that of a single physical disk.

RAID 0 arrays do not store redundant data, so they are not true RAID applications. If one disk fails, the entire array fails and all array data is lost. The fault tolerance of a RAID 0 array, therefore, is less than that of any single disk in the array. The term RAID 0 is widely used for these arrays, however, because they are conceptually similar to true RAID applications.

A.1.2 RAID 1, RAID 10 (Mirrored Disks)

In RAID 1 and RAID 10 arrays (commonly called *mirrored arrays*) disks are paired, with both disks in a pair containing the same data. When data is written to a mirrored array, it is written twice—once to each disk in the pair. A RAID 1 array has only one set of paired disks. A RAID 10 array has multiple pairs, across which data is striped.

The read performance of RAID 1 arrays can be much better than that of a single disk, while the write performance is slightly lower. In RAID 10 arrays, both read performance and write performance are better than those of a single disk.

A mirrored array is also highly reliable, because both disks *in a pair* must fail for the array to fail. In an array with five pairs of mirrored disks, for example, the array can maintain its integrity even if five disks fail; as long as each pair is left with one good disk. The main disadvantage of a mirrored array is its cost. Because all disks must have a twin, you must use twice the number of disks that actually contribute to the array capacity. In an eight-disk array, for example, you have only four disks of usable capacity.

A.1.3 RAID 3

RAID 3 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. The user data is distributed across all but one of the disks in the array. The parity data is written exclusively to the *parity disk* (also known as the *check disk*). In the event of a disk failure, the data can be reconstructed from corresponding data stripes on the remaining disks in the array.

RAID 3 provides excellent I/O performance for applications that require high data transfer rates such as image processing, video processing, scientific data collection, batch data processing, or sequential reads and writes.

RAID 3 is not well suited for transaction processing or other applications that require simultaneous reads and writes.

A.1.4 RAID 4

RAID 4 is similar to RAID 3 in that the redundant information is achieved in the form of parity data. The user data is distributed across all but one of the disks. The Galaxy 65 Subsystem uses a single, dedicated parity drive for data protection. The main difference is that RAID 3 usually synchronizes writes to its disks, while RAID 4 can send data to its disk independently.

RAID 4 is best suited for transaction processing applications that require high read requests, but not write requests such as inquires rather than updates.

RAID 4 is not recommended for I/O-intensive applications that require high data transfer rates.

A.1.5 RAID 5

RAID 5 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. The parity information is distributed across the disks in the array and occupies the equivalent capacity of approximately one disk. Data is interspersed with the parity information. If one disk in the array fails, the data on the failed disk can be reconstructed from the parity data and user data on the remaining disks. Two disks must fail before the entire array fails.

The read performance of a RAID 5 array is excellent, comparable to that of a RAID 0 array. Write performance is lower than that of a RAID 0 array, because write operations involve calculating and writing new parity data as well as writing the new user data.

A.1.6 RAID 50

RAID 50 arrays are made up of two or more RAID 5 arrays, across which data is striped. RAID 50 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. As in a RAID 5 array, the parity information is distributed across the disks in the array and occupies the equivalent capacity of one disk per RAID 5. Data is interspersed with the parity information. If one disk in the array fails, the data on the failed disk can be reconstructed from the parity data and user data on the remaining disks. Two disks in one RAID 5 subset must fail before the entire array fails.

The read performance of a RAID 50 array is excellent—better than a RAID 5 array—along with better data protection. Write performance is lower than that of a RAID 0 array, because write operations involve calculating and writing new parity data as well as writing the new user data.

A.1.7 Volume Sets

A volume set provides the ability to create a host-accessible LUN that maps to a single disk in the array, similar to JBOD. Volume sets are non redundant and have a capacity slightly less than the physical disk they are created from. Volume sets are useful if you have a single disk available and you do not want to use it as a spare.

Note For more information on RAID levels, see *The RAIDbook: A Source Book for RAID Technology*, published by the RAID Advisory Board (St. Peter, Minnesota, February, 1996).

A.2 Comparing RAID Levels

Table 1–2 illustrates the differences between the different RAID levels.

Table 1–2 Comparing RAID levels

RAID Level	Min No. of Drives	Description	Strengths	Weaknesses
RAID 0	2	Data striping without redundancy	Highest performance	No data protection—one drive fails, all data is lost
RAID 1	2	Disk mirroring	Very high: Performance Data protection Minimal penalty on write performance	High redundancy cost overhead—because all data is duplicated, twice the storage capacity is required
RAID 2	N/A	No practical use	Previously used for RAM error environments correction (known as Hamming Code) and in disk drives before the use of embedded error correction	No practical use—same performance can be achieved by RAID 3 at lower cost
RAID 3	3	Block-level data striping with dedicated parity drive	Excellent performance for large, sequential data requests	Not well-suited for transaction-oriented network applications; single parity drive does not support multiple, concurrent write requests
RAID 4 (Not widely used)	3	Block-level data striping with dedicated parity drive	Data striping supports multiple simultaneous read requests	Write requests suffer from same single parity-drive bottleneck as RAID 3; RAID 5 offers equal data protection and better performance at same cost
RAID 5	3	Block-level data striping with distributed parity	Best cost/performance for transaction-oriented networks; very high performance and data protection; supports multiple simultaneous reads and writes; can also be optimized for large, sequential requests	Write performance is slower than RAID 0 or RAID 1
RAID 50	6	Combination of RAID 0 (data striping) and RAID 5 with distributed parity	Better random performance and data protection than RAID 5; supports more drives than RAID 5	Lower storage capacity than RAID 5

Table 1–2 Comparing RAID levels (Continued)

RAID Level	Min No. of Drives	Description	Strengths	Weaknesses
RAID 10 (Also known as mirrored)	4	Combination of RAID 0 (data striping) and RAID 1 (mirroring)	Highest performance and data protection (can tolerate multiple drive failures)	High redundancy cost overhead; because all data is duplicated, twice the storage capacity is required; requires minimum of four drives
Volume Sets	1	Non-RAID, non-striped mapping to a single drive (similar to JBOD)	Ability to use a single drive to store additional data	Not protected, lower performance (not striped)

A.3 Mixing Disks from Different Manufacturers or with Different Capacities

An array can contain disks with different capacities; for example, an array can include a 36-GB disk and a 72-GB disk. If you mix disks with different capacities, the smallest disk determines the logical capacity of all other disks in the array, regardless of RAID level. For example, if a RAID 0 array contains one 36-GB disk and four 72-GB disks, the capacity of the array is equivalent to approximately five 36-GB disks. To maximize disk capacity, use disks of similar size.

Important **The manufacturer does not support mixing of different models, or manufacturer's, of drives in the same enclosure.**

Appendix B

Accessing Disk Array Administrator Software

The remaining appendices of the *Guide* describe how to manage your Galaxy 65 Subsystem using the menu-based Disk Array Administrator.

You can display and change a variety of settings using the Disk Array Administrator software. Using the Disk Array Administrator, you can:

- Create and manage arrays
- Monitor system status
- Manage spares
- Configure the Galaxy 65 Subsystem
- Manage disk drives and enclosures

You can access the Disk Array Administrator software using the RS-232 serial port or the Ethernet port connections on the SMs. You must connect a computer with terminal emulator software to the serial or Ethernet port.

Each SM has one RS-232 and one Ethernet port. You have access to all host and disk ports on all installed LRC I/O modules from either SM. However, you can only manage arrays and dedicated spares from the SM where the array was created, that is, each SM can only see its own arrays and dedicated spares. Each SM can see all pool spares and available drives (drives not used in an array or as a dedicated spare).

You must perform some configuration functions from the SM where you want the change to take place:

- Updating firmware
- Configuring LAN settings
- Creating and managing arrays, partitions, and dedicated spares

You can perform other configuration functions from either SM and have the same changes made automatically on the other SM:

- Managing pool spares
- Configuring host channels
- Configuring disk channels
- Configuring the following Galaxy 65 Subsystem settings:
  - Alarm mute
  - Lock cache
- Configuring the following disk settings:
  - Write-back cache
  - SMART
  - Enclosure management processor (EMP)

B.1 Accessing the Disk Array Administrator Using the RS-232 Serial Port

You can access the Disk Array Administrator software using the RS-232 serial port. You must use a straight-through serial cable. You cannot use a null modem cable.

Configure the RS-232 port in your terminal emulator software using the following settings:

Setting	Value
Terminal Emulation	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

Set the communications parameters for the terminal program as follows:

Setting	Value
Baud Rate	115,200
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	Software (XON/XOFF) or None
Connector	COM1 (typically)

To access the Disk Array Administrator software using the RS-232 serial port:

1 From the computer connected to the Galaxy 65 Subsystem, start your terminal emulation software.

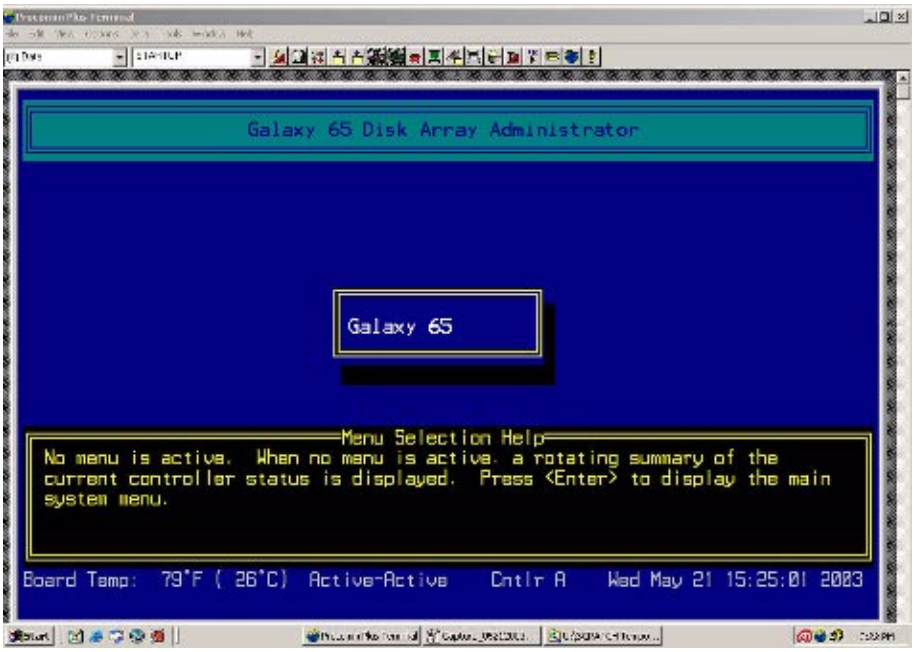
Be sure that your terminal emulation software is set to use the correct COM port on your computer. See section 7.14, "Terminal Emulator and COM Port Problems", on page 76 for more details on how the Galaxy 65 Subsystem can auto-detect the baud rate.

2 Press **CTRL-R**.

This refreshes the screen.

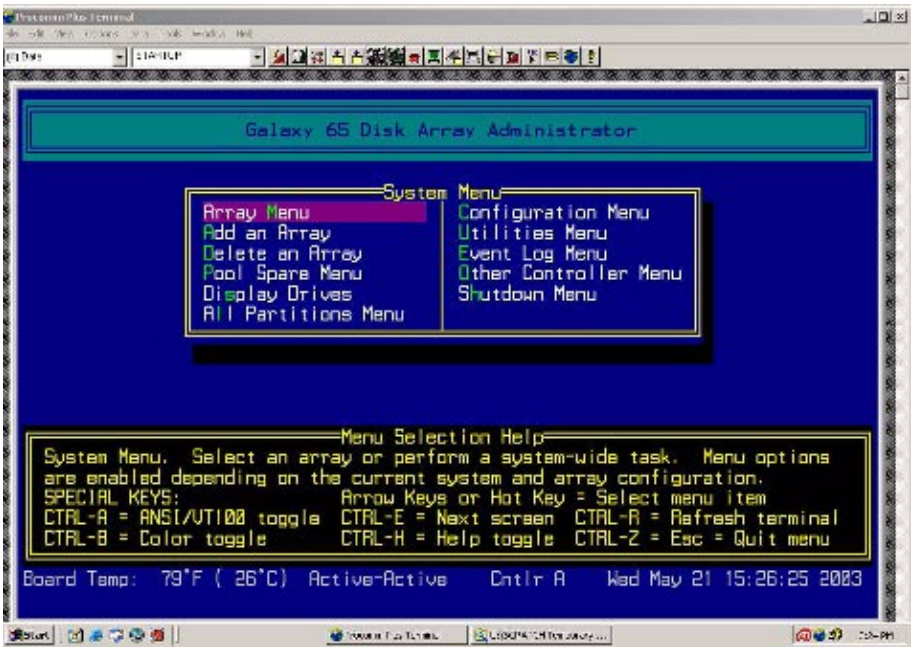
The initial SM Disk Array Administrator screen displays. If any events have occurred, each event displays. Informational events scroll by automatically. Warning events (yellow text on a black background) and error events (white text on a red background) display until you press **Enter** or **Esc**. Once all the events display, the initial screen displays. The initial screen alternates between displaying the date, time, and temperature and the model number of your Galaxy 65 Subsystem.

You can bypass all events by pressing **Tab**. However, events provide valuable information about the status of your Galaxy 65 Subsystem and you should review them. All events are also stored in the event log (see D.2, "Displaying the Event Log", on page 154).


Galaxy 65 Disk Array Administrator
Galaxy 65
Menu Selection Help
No menu is active. When no menu is active, a rotating summary of the current controller status is displayed. Press <Enter> to display the main system menu.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:25:01 2003

3 Press **Enter**.

The System Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions Menu
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Shutdown Menu
Menu Selection Help
System Menu. Select an array or perform a system-wide task. Menu options are enabled depending on the current system and array configuration.
SPECIAL KEYS: Arrow Keys or Hot Key = Select menu item
CTRL-A = ANSI/VT100 toggle CTRL-E = Next screen CTRL-R = Refresh terminal
CTRL-B = Color toggle CTRL-H = Help toggle CTRL-Z = Esc = Quit menu
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:26:25 2003

You can now perform all of the functions described in the following chapters. All steps start from the System Menu.

B.2 Accessing the Disk Array Administrator Using the Ethernet Port

You can access the Disk Array Administrator software using the Ethernet port and Telnet. Windows users may want to obtain a terminal emulator program such as HyperTerminal Private Edition from Hilgraeve that supports both Telnet protocol and serial port protocol. In addition, such programs support the color display from the Disk Array Administrator.

You can configure a variety of settings for the Ethernet connection. For more information, see H.2, ”Configuring the LAN Settings”, on page 214.

B.2.1 Using the Ethernet Port for the First Time

Before you can access the Disk Array Administrator software, you must set the IP address and subnet mask for the SM. The default IP address is 10.0.0.1 and the default port number is 23. You can do this one of three ways:

- Setting up your computer with an IP address that is compatible with the Galaxy 65 default of 10.0.0.1, such as 10.0.0.42.

- Using the serial connection to the SM and setting the address. See H.2.1, ”Configuring the IP Settings”, on page 214.

Once you set the IP address and subnet mask, you can use the steps in the next section to access the Disk Array Administrator software.

B.2.2 Accessing the Disk Array Software Using the Ethernet Port

Note You can use the RS-232 and Telnet connections at the same time. If a Telnet session is active, you can see the activity through the RS-232 connection, and you can make changes to the configuration using the RS-232 connection.

You can configure a variety of settings for the Ethernet connection. For more information, see H.2, ”Configuring the LAN Settings”, on page 214.

To access the Disk Array Administrator software using the Ethernet port and the Telnet utility:

1. Set up the IP address and subnet mask as described in B.2.1, ”Using the Ethernet Port for the First Time”, on page 98.

2. At the DOS or UNIX prompt, enter **telnet** and press **Enter**.

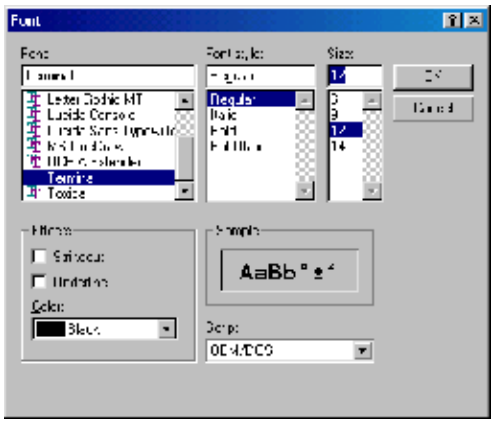
   The exact steps for your Telnet program may be different. The remaining steps work for HyperTerminal Private Edition.

3. Using the **Terminal** menu, select **Preferences**.

4. Select **VT100 Arrows** option, **VT-100/ANSI** emulation, and **Terminal** font. Click **OK**.

   If you are using Windows and Telnet, you must configure the preferences and font from the Terminal menu each time as shown below.

Click **Font** to set the font as shown here.



5. Enter the IP address or, using the Connect menu, select the Galaxy 65 IP address from the menu (if present) and press **Enter**.

If needed, enter the port number. The default port is 23.

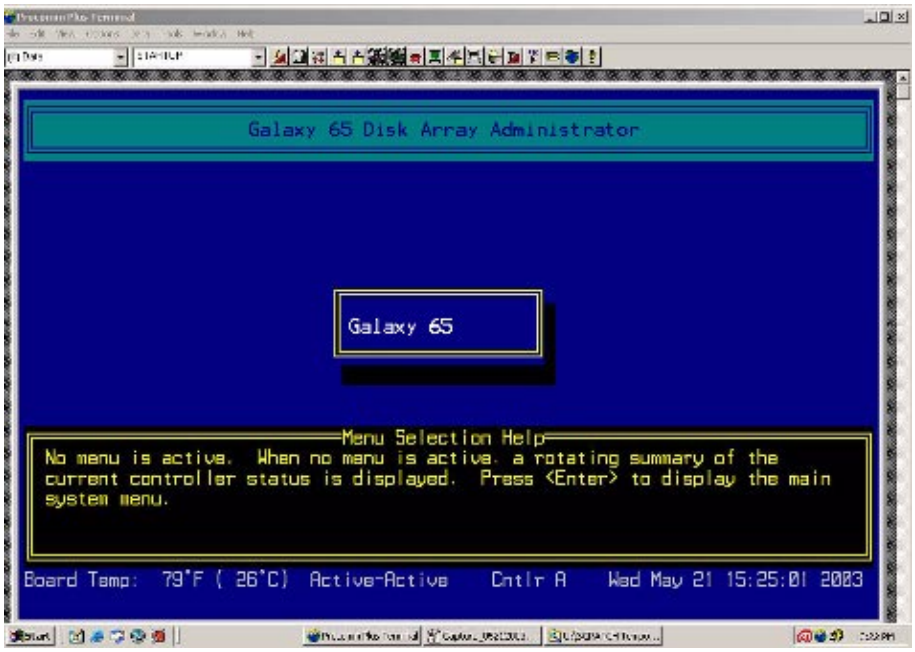
The Enter Password screen displays.

6 Enter your password and press **Enter**.

There is no default password. If you have not set up a password, just press **Enter**.

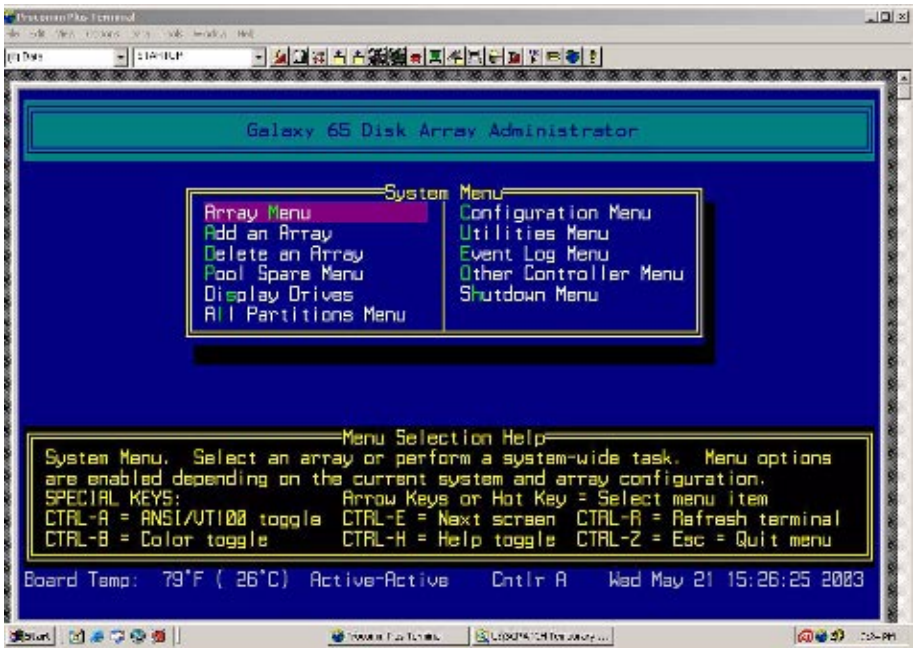
The initial Rorke Data Disk Array Administrator screen displays. If any events have occurred, each event displays. Informational events scroll by automatically. Warning events (yellow text on a black background) and error events (white text on a red background) display until you press **Enter** or **Esc**. Once all the events display, the initial screen displays. The initial screen alternates between displaying the date, time, and temperature and the model number of your Galaxy 65 Subsystem.

You can bypass all events by pressing **Tab**. However, events provide valuable information about the status of your Galaxy 65 Subsystem and you should review them. All events are also stored in the event log (see D.2, ”Displaying the Event Log”, on page 154).


Galaxy 65 Disk Array Administrator
Galaxy 65
Menu Selection Help
No menu is active. When no menu is active, a rotating summary of the current controller status is displayed. Press <Enter> to display the main system menu.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:25:01 2003

7 Press **Enter**.

The System Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions Menu
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Shutdown Menu
Menu Selection Help
System Menu. Select an array or perform a system-wide task. Menu options are enabled depending on the current system and array configuration.
SPECIAL KEYS:
Arrow Keys or Hot Key = Select menu item
CTRL-A = ANSI/VT100 toggle
CTRL-E = Next screen
CTRL-R = Refresh terminal
CTRL-B = Color toggle
CTRL-H = Help toggle
CTRL-Z = Esc = Quit menu
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:26:25 2003

You can now perform all of the functions described in the following chapters. All steps start from the System Menu.

B.3 Navigating the Disk Array Administrator Software

You can navigate the Disk Array Administrator software using your keyboard. Table 2–1 describes the primary navigation and selection methods.

Table 2–1 Disk Array Administrator navigation

To	Do this
Select a menu item	Press the ↑ or ↓ and press **Enter**. or Press the letter that is a different color (or highlighted) in a menu item (hot key).
Return to the previous menu or screen without saving your changes	Press **Esc, CTRL-Z,** or ←.
Scroll through the available choices for a setting	Press the ↑ or ↓.
Bypass the list of recent events	Press **Tab**

Note After four minutes of inactivity, the Disk Array Administrator software times out and returns to the initial screen.

B.3.1 Changing the Screen Display

After you have accessed the Disk Array Administrator software, you can change the screen display using a combination of keystrokes, as shown on the System Menu. Table 2–2 lists the keystrokes required to change various screen displays.

Table 2–2 Changing screen displays

Select	Function
Ctrl-A	Toggles between ANSI and VT100 character sets (use VT100 for legacy systems)
Ctrl-B	Toggles between black and white and color
Ctrl-E	Toggles between the event log, hardware information, and configuration information screens
Ctrl-H	Toggles between the Help screen and list of shortcut keys
Ctrl-R	Refreshes screen
Ctrl-Z, Esc, or ←	Escapes or quits the current menu

B.3.2 Disk Array Administrator Menu Tree

Figure 2–1 and Figure 2–2 describe the complete Disk Array Administrator menu hierarchy. In the Disk Array Administrator, menu options that are not accessible appear gray. For example, the Array Menu is not accessible unless one or more arrays exist.

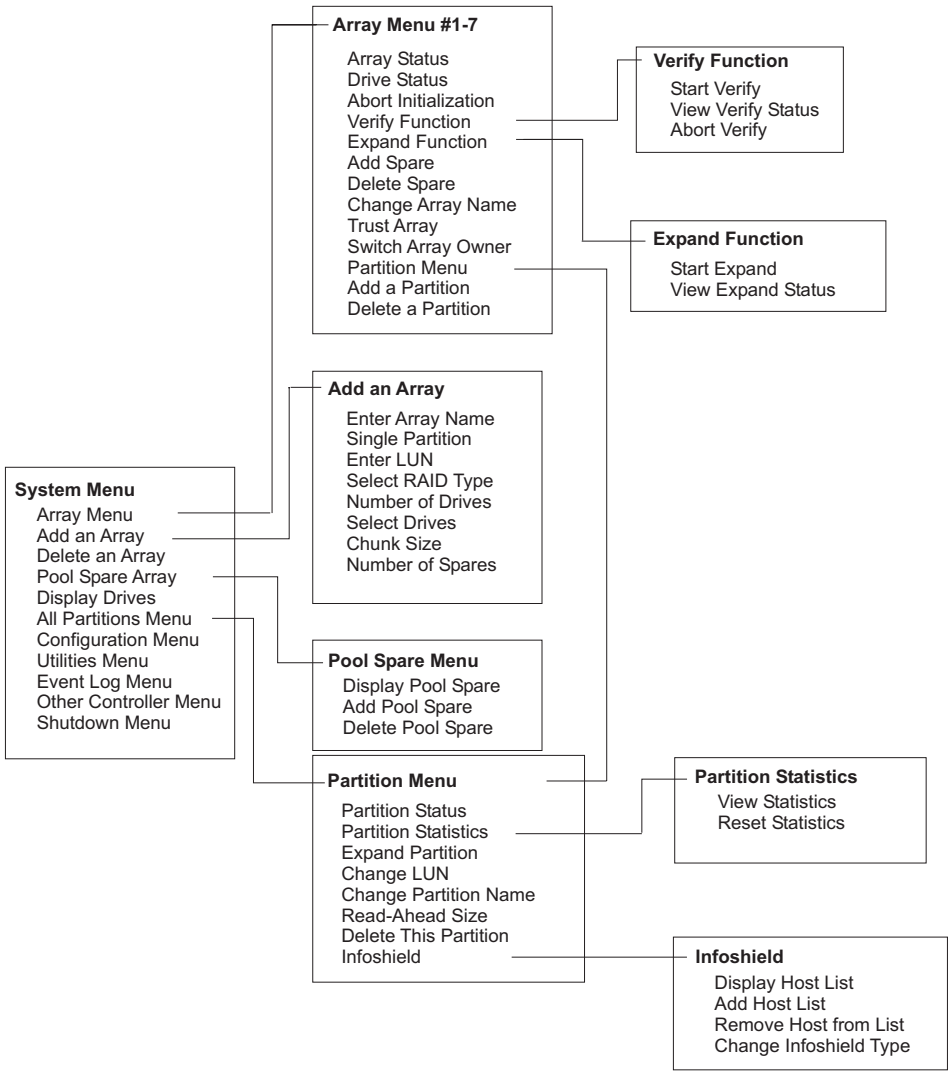


Figure 2–1 Menu Tree (sheet 1)

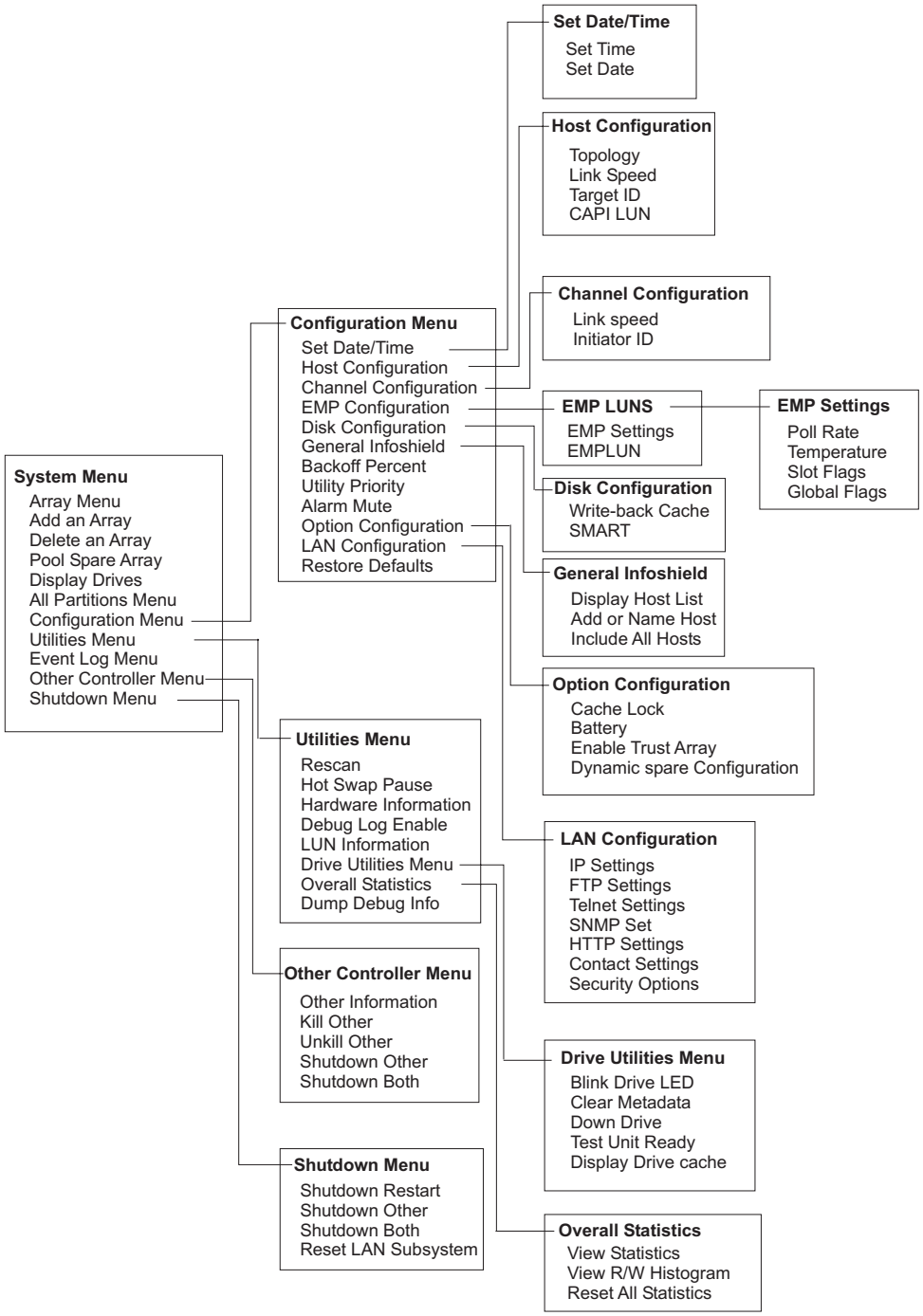


Figure 2–2 Menu Tree (sheet 2)

Appendix C

Creating and Managing Arrays & Partitions

Using the Disk Array Administrator, you can create and manage arrays and partitions. You can perform the following array-related functions:

- Create arrays (see page 105)
- Manage arrays (see page 116)
- Manage partitions (see page 133)

C.1 Creating Arrays

You can create an array anytime. You can create arrays from either SM A or SM B. Arrays you create from one SM are not visible through the RS-232 or Ethernet port of the other SM. However, all unused disk drives connected to all LRC I/O modules and all pool spares are available to both SMs.

The maximum size for any array is 2 TB. Table 3–1 describes the drive requirements for each RAID level.

Table 3–1 Drive requirements by RAID level

RAID level	Minimum number of drives	Maximum number of drives
Volume Set	1	1
RAID 0	2	16
RAID 1 (Mirrored)	2	16
RAID 3	3	16
RAID 4	3	16
RAID 5	3	16
RAID 50	6	32

Note Before you create more than one array, you must be sure that your host operating system supports multiple logical unit numbers (LUNs). Most operating systems do, or have an option you can enable to support multiple LUNs. If your operating system does not support multiple LUNs, the host will only be able to see one array at LUN 0.

Before you create an array, you must decide whether you want to partition the array. You can create an array one of two ways:

- As a **single-partition array**: an array that stores all data in a single partition and is accessed by a single LUN.
- As a **multiple-partition array**: an array that can have one or more partitions, with each partition assigned its own LUN.

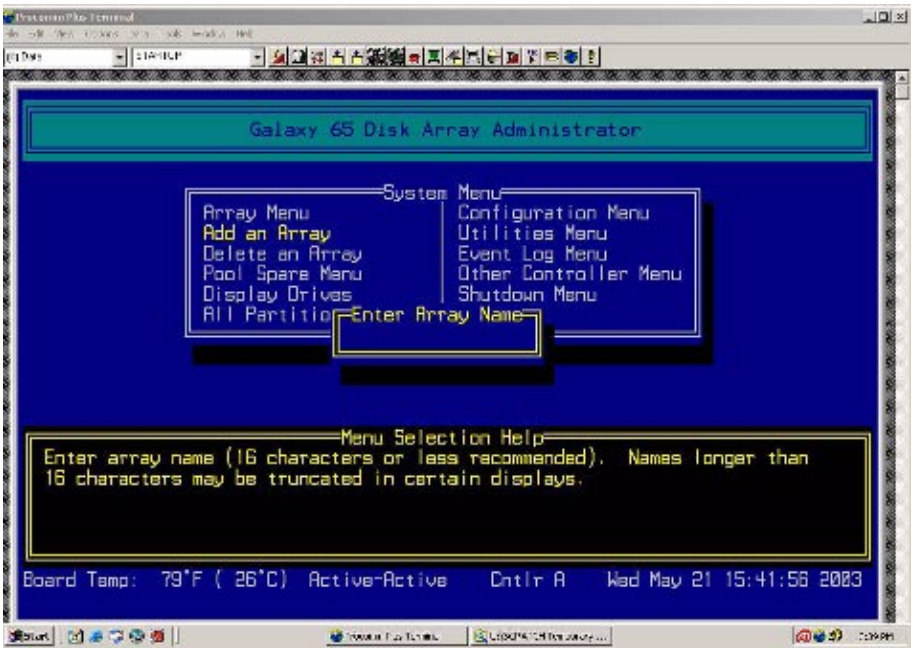
For more information about partitions, see C.3.1, ”Understanding Partitions”, on page 133.

C.1.1 Creating a Single-Partition Array

You can create an array that has just one partition. Once you create a single-partition array, you cannot add more partitions. Single-partition arrays work well in environments that need one large, fault-tolerant storage space for data on one server. A large database accessed by users on a single server that is used only for that application is an example.

To create a single-partition array:

1 From the System Menu, select **Add an Array** and press **Enter**.
The Enter Array Name screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitio
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Shutdown Menu
Enter Array Name
Menu Selection Help
Enter array name (16 characters or less recommended). Names longer than 16 characters may be truncated in certain displays.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:41:56 2003

2 Enter a name for the array and press **Enter**.

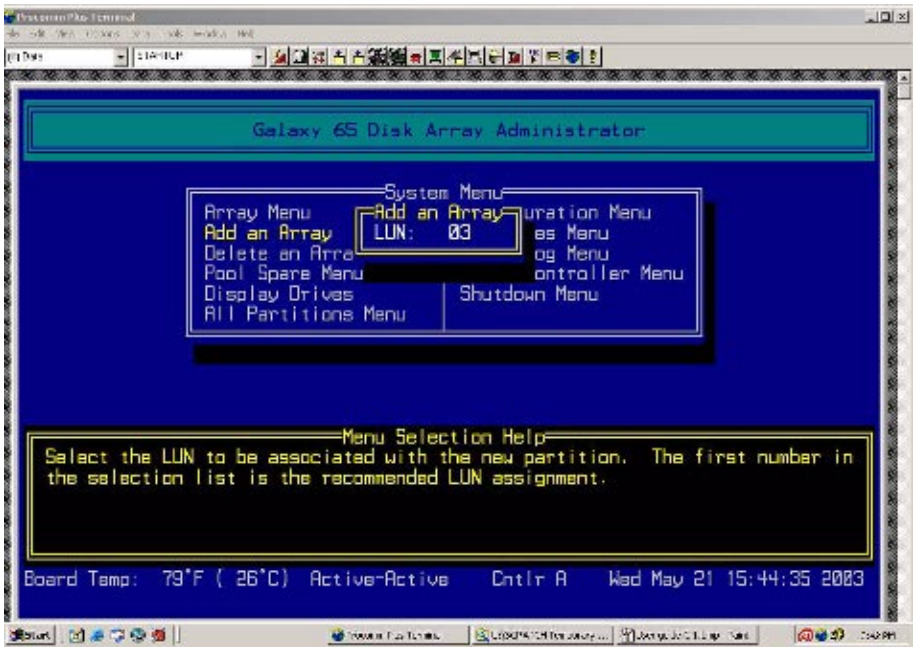
You can use up to 20 characters. You can include any characters in the name, including spaces. If you do not want to name the array, you can just press **Enter**. You can add or change the name later.

The system asks if you want to create one partition now for the entire array.

3 Select **Yes** to create a single-partition array and press **Enter**.

If you want to create a multiple-partition array, see C.1.2, ”Creating a Multiple-Partition Array”, on page 111

The LUN screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Arra
Pool Spare Menu
Display Drives
All Partitions Menu
Add an Array
LUN: 03
uration Menu
es Menu
og Menu
ontroller Menu
Shutdown Menu
Menu Selection Help
Select the LUN to be associated with the new partition. The first number in the selection list is the recommended LUN assignment.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:44:35 2003

4 Select the LUN for the array and press **Enter**.
The LUN that displays is the suggested default LUN assignment.

Note Most UNIX, Linux, and Macintosh operating systems require that the CAPI LUN, which is the LUN assigned to each SM, be set to a higher value than all array LUNs. Before creating your first array, change the CAPI LUN to a higher value. If you are using a custom software application to configure and manage the controller (this application uses CAPI to communicate with the Galaxy 65), you must have a CAPI LUN. If you are not using a custom application, and therefore are not using CAPI, select NONE as the CAPI LUN. This allows your first array to be seen at LUN 0.

The system warns you about the LUN for UNIX and Macintosh, as above, the first time you create an array. Press **Enter** and the system asks if you want to be warned again. Select **No** to avoid receiving this warning again or select **Yes** to be warned the next time you create an array.

The RAID Type screen displays.

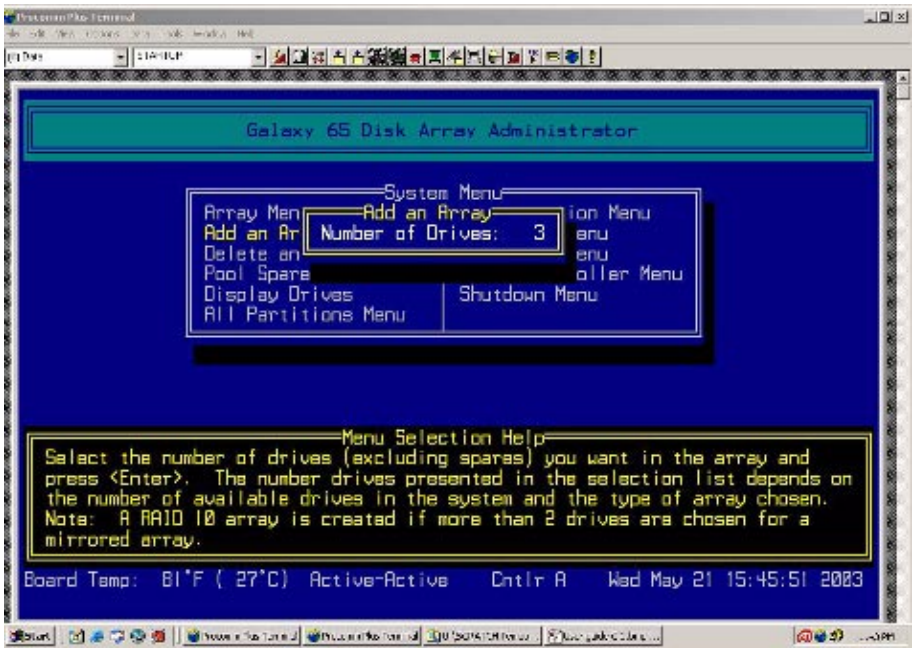
5 Select the RAID type: **RAID0**, **RAID3, RAID4, RAID5, RAID50, VOLUME** (a single drive similar to just a bunch of disks [JBOD] except that it includes metadata), or **MIRRORED** and press **Enter**.

Note A RAID 10 array is created when there are more than two drives in a mirrored array.

See , "Array Basics", on page 89, for more information.

If you selected RAID 50 as the array type, the Select RAID 50 Array Size screen displays (not shown) with all possible configurations for the array and drive combinations. Select the configuration you want, press **Enter**, and skip to step 7.

If you selected any array type other than RAID 50, the Number of Drives screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Add an Array
Number of Drives: 3
Array Men
Add an Ar
Delete an
Pool Spare
Display Drives
All Partitions Menu
Shutdown Menu
Menu Selection Help
Select the number of drives (excluding spares) you want in the array and press <Enter>. The number drives presented in the selection list depends on the number of available drives in the system and the type of array chosen.
Note: A RAID 10 array is created if more than 2 drives are chosen for a mirrored array.
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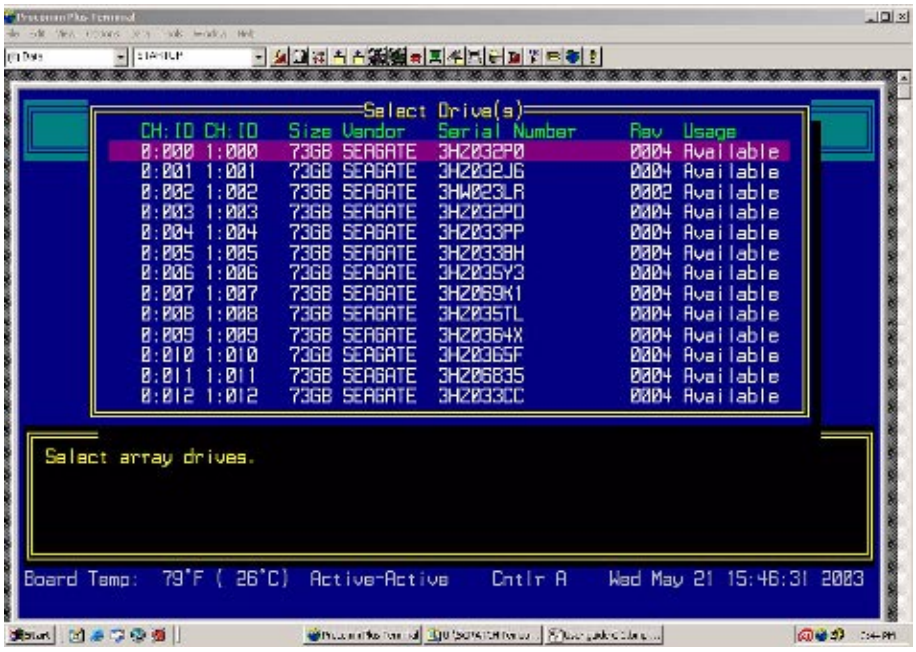
6 Enter the number of drives (excluding spares) you want in the array and press **Enter**.

The Select Drives screen displays. The list includes all available drives, that is, drives that are not members of an array and are not assigned as a dedicated or pool spare, on either SM. The screen includes the following information for each drive:

- Loop ID for each channel; ------ shows a single ported drive)
- Size
- Vendor
- Model or serial number or node and WWN (press **T** to toggle the display)
- Rev (firmware revision)
- Usage
- Drive usage


Select Drive(s)
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:000 1:000 73GB SEAGATE 3HZ032P0 0004 Available
0:001 1:001 73GB SEAGATE 3HZ032J6 0004 Available
0:002 1:002 73GB SEAGATE 3HW023LR 0002 Available
0:003 1:003 73GB SEAGATE 3HZ032PD 0004 Available
0:004 1:004 73GB SEAGATE 3HZ033PP 0004 Available
0:005 1:005 73GB SEAGATE 3HZ0338H 0004 Available
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Available
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Available
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Available
0:009 1:009 73GB SEAGATE 3HZ0364X 0004 Available
0:010 1:010 73GB SEAGATE 3HZ0365F 0004 Available
0:011 1:011 73GB SEAGATE 3HZ06835 0004 Available
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Available
Select array drives.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:46:31 2003

7 Select the drives you want to use for the array and press **Enter**.

You select a drive by highlighting it and pressing **Enter**. Each selected drive turns gray in the drive list. After you press **Enter** for the number of drives you entered previously, the system automatically goes to the next screen. To skip a drive, use the ↑ or ↓ key.

You may want to select drives from different disk channels (I/O modules), which keeps the array online even if one channel becomes unavailable.

If the array is mirrored, RAID 3, RAID 4, RAID 5, or RAID 50 *and* you have one or more drives left, the Number of Spares screen displays.

8 If the Number of Spares screen displays, enter the number of spares you want to add and press **Enter**.

This creates dedicated spares that can only be used by this array. A dedicated spare drive will not be available for any other use.

If you do not want a dedicated spare, enter **0**.

The Select Drives screen displays.

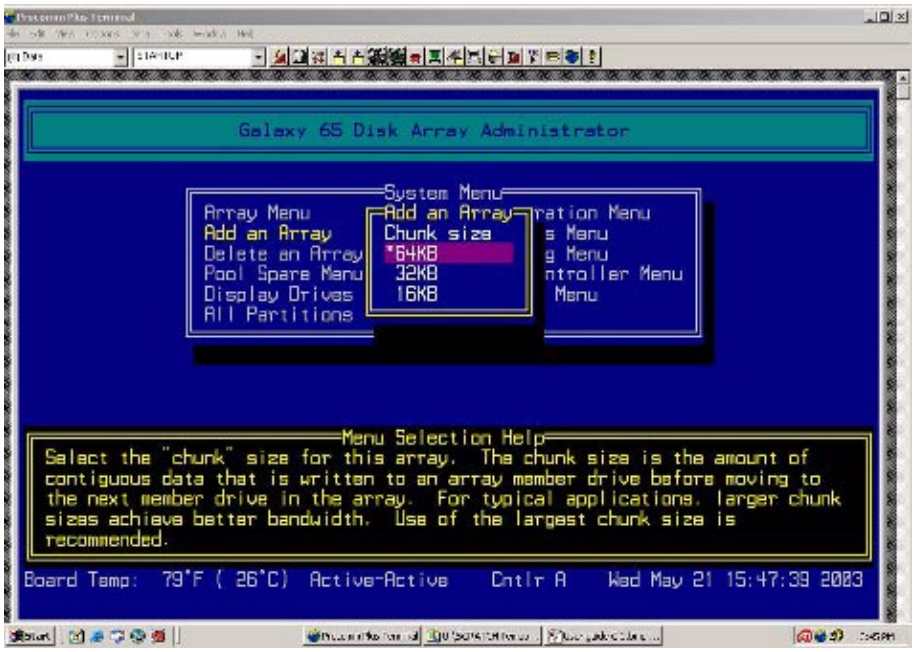
9 If the Select Drives screen displays, select the drive you want to use as a dedicated spare and press **Enter**.

Only available drives, that is, drives that are not members of an array and are not assigned as dedicated or pool spares, display. You can delete a dedicated spare from the array at any time. For more information, see E.1.2, ”Deleting a Dedicated Spare”, on page 168.

You select a drive by highlighting it and pressing **Enter**. Each selected drive turns gray in the drive list. After you press **Enter** for the number of drives you entered previously, the system automatically goes to the next screen. To skip a drive, use the ↑ or ↓ key.

To toggle the display between the drive model number, serial number, and the node and WWN, press **T**.

If the array you are creating is a RAID 0, RAID 3, RAID 4, RAID 5, RAID 10, or RAID 50, the Chunk Size screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions
Add an Array
Chunk size
*64KB
32KB
16KB
Menu Selection Help
Select the "chunk" size for this array. The chunk size is the amount of contiguous data that is written to an array member drive before moving to the next member drive in the array. For typical applications, larger chunk sizes achieve better bandwidth. Use of the largest chunk size is recommended.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:47:39 2003

10 If the Chunk Size screen displays, select the chunk size and press **Enter**.

The chunk size is the amount of contiguous data that is written to an array member before moving to the next member of the array. To determine the appropriate chunk size, refer to your operating system documentation. For example, the default chunk size for Windows NT and many other operating systems is 64 KB. If you are using the array for a database with very small records, you may want to use a smaller chunk size.

If the array you are creating is a RAID 3, RAID 4, RAID 5, RAID 50, or Mirrored, the Array Init Options screen displays. The current option has an * next to it.

11 If the Array Init Options screen displays, select the option you want and press **Enter**.

- **Offline Initialization**: Using this option means you must wait for the array initialization process to finish before using the array. It uses the zero method to create the array, which is faster than the verify method.
- **Online Initialization**: Using this option lets you begin using the array immediately after creating it, while the array initialization process runs. It uses the verify method to create the array, which takes longer than the zero method.

The system confirms that you want to create the array.

12 Select **Yes** and press **Enter**.

A message notifies you that the array is being created and shows the progress of the initialization process. The array initialization process takes from several minutes to more than an hour depending on the array type (volume, RAID 0, and RAID 1 are the fastest), array size, drive speed, and other processes running on the Galaxy 65 Subsystem.

You can press **Esc** to return to the Disk Array Administrator menus and perform other functions. To check the progress of the array initialization, select **Array Menu** from the System Menu. The status of the initialization displays in the list of arrays.

If you find that you need to change the disks or some other array configuration, you can stop the array initialization process. See C.2.2, ”Stopping the Array Initialization Process”, on page 120.

Note Most operating systems, such as Windows NT 4.0, require you to restart the host system to see a new LUN. Windows 2000 can recognize new LUNs by selecting Refresh from the Computer Management Window. NetWare v3.12 and later can recognize new devices by typing the command SCAN FOR NEW DEVICES at the console prompt. Other operating systems might have similar features.

C.1.2 Creating a Multiple-Partition Array

You can create an array that is set up for more than one partition.

Note Once you create a multiple-partition array, you must create at least one partition before you can use the array. See C.2.3, ”Adding a Partition”, on page 121.

Multiple-partition arrays work well when you have very large disk drives and you want to make the most efficient use of disk space for fault tolerance (parity and spares). For more information, see C.3.1, ”Understanding Partitions”, on page 133.

To create a multiple-partition array:

1 From the System Menu, select **Add an Array** and press **Enter**.
The Enter Array Name screen displays.

2 Enter a name for the array and press **Enter**.

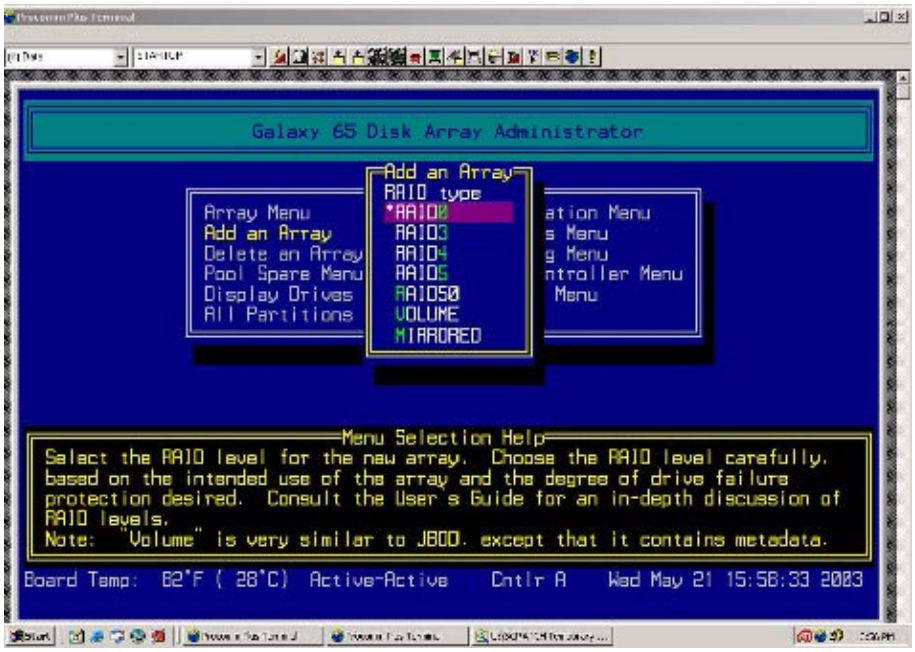
You can use up to 20 characters. You can include any characters in the name, including spaces. If you do not want to name the array, you can just press **Enter**. You can add or change the name later.

The system asks if you want to create one partition now for the entire array.

3 Select **No** to create a multiple-partition array and press **Enter**.

If you want to create a single-partition array, see C.1.1, ”Creating a Single-Partition Array”, on page 106.

The RAID Type screen displays.


Galaxy 65 Disk Array Administrator
Add an Array
RAID type
*RAID0
RAID3
RAID4
RAID5
RAID50
VOLUME
MIRRORED
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions
Menu Selection Help
Select the RAID level for the new array. Choose the RAID level carefully, based on the intended use of the array and the degree of drive failure protection desired. Consult the User's Guide for an in-depth discussion of RAID levels.
Note: "Volume" is very similar to JBOD, except that it contains metadata.
Board Temp: 82°F (28°C) Active-Active Cntlr A Wed May 21 15:58:33 2003

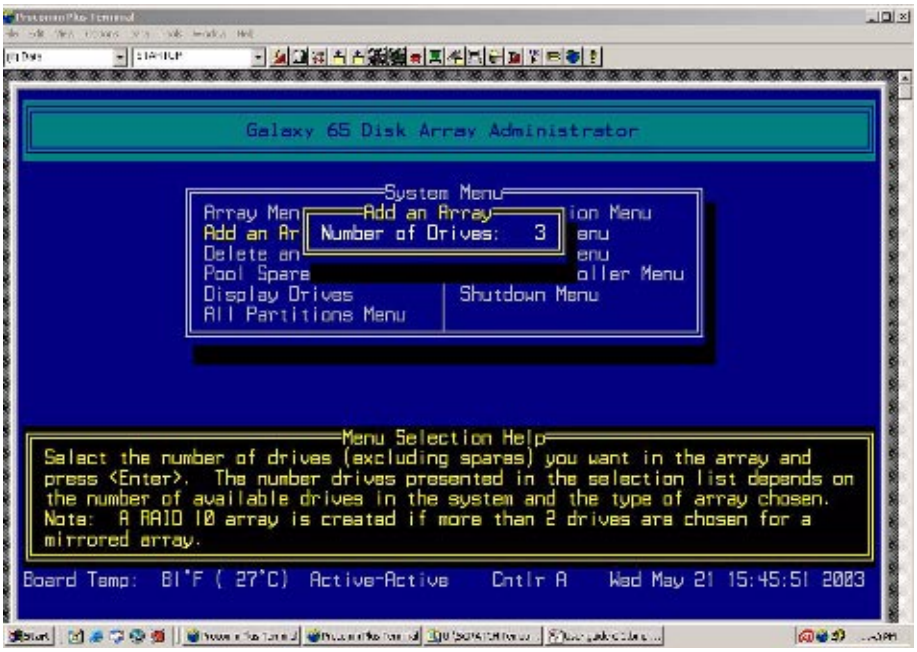
4 Select the RAID type: **RAID0**, **RAID3, RAID4, RAID5, RAID50, VOLUME** (a single drive similar to just a bunch of disks (JBOD) except that it includes metadata), or **MIRRORED** and press **Enter**.

Note A RAID 10 array is created when there are more than two drives in a mirrored array.

See , ”Array Basics”, on page 89, for more information.

If you selected RAID 50 as the array type, the Select RAID 50 Array Size screen displays (not shown) with all possible configurations for the array and drive combinations. Select the configuration you want, press **Enter**, and skip to step 7.

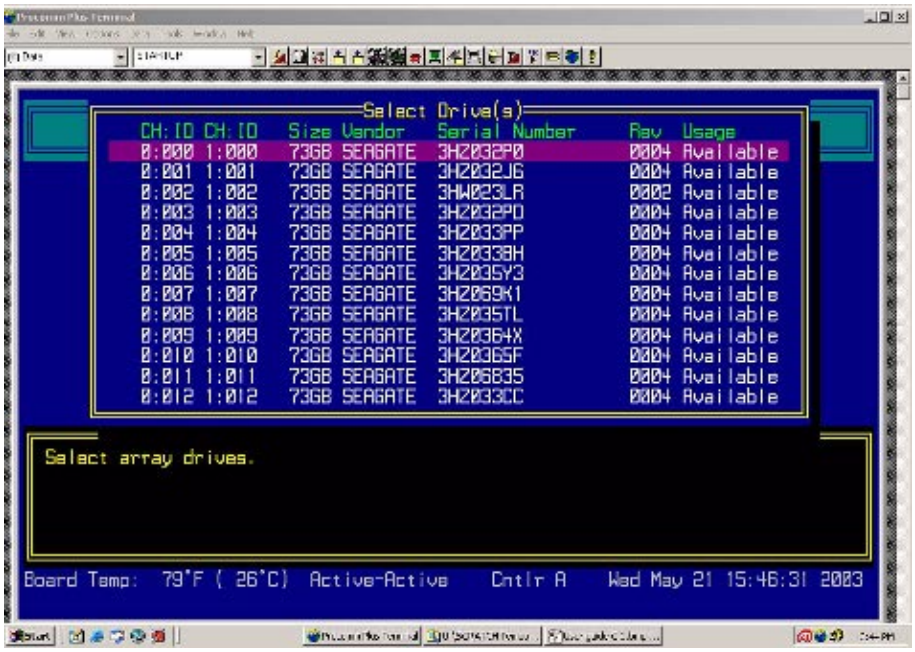
If you selected any array type other than RAID 50, the Number of Drives screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Add an Array
Number of Drives: 3
Shutdown Menu
Menu Selection Help
Select the number of drives (excluding spares) you want in the array and press <Enter>. The number drives presented in the selection list depends on the number of available drives in the system and the type of array chosen.
Note: A RAID 10 array is created if more than 2 drives are chosen for a mirrored array.
Board Temp: 81°F (27°C) Active-Active Cntlr A Wed May 21 15:45:51 2003

5 Enter the number of drives (excluding spares) you want in the array and press **Enter**.

The Select Drives screen displays (shown below). The list includes all available drives, that is, drives that are not members of an array and are not assigned as a dedicated or pool spare, on either SM:

- Loop ID for each channel; ----- shows a single ported drive)
- Size
- Vendor
- Model, serial number, or node and WWN (press **T** to toggle the display)
- Rev (firmware revision)
- Usage


Select Drive(s)
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:000 1:000 73GB SEAGATE 3HZ032P0 0004 Available
0:001 1:001 73GB SEAGATE 3HZ032JG 0004 Available
0:002 1:002 73GB SEAGATE 3HW023LR 0002 Available
0:003 1:003 73GB SEAGATE 3HZ032PD 0004 Available
0:004 1:004 73GB SEAGATE 3HZ033PP 0004 Available
0:005 1:005 73GB SEAGATE 3HZ0338H 0004 Available
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Available
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Available
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Available
0:009 1:009 73GB SEAGATE 3HZ0364X 0004 Available
0:010 1:010 73GB SEAGATE 3HZ0365F 0004 Available
0:011 1:011 73GB SEAGATE 3HZ06B35 0004 Available
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Available
Select array drives.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:46:31 2003

6 Select the drives you want to use for the array and press **Enter**.

You select a drive by highlighting it and pressing **Enter**. Each selected drive turns gray in the drive list. After you press **Enter** for the number of drives you entered previously, the system automatically goes to the next screen. To skip a drive, use the ↑ or ↓ key.

You may want to select drives from different disk channels (I/O modules), which keeps the array online even if one channel becomes unavailable.

If the array is mirrored, RAID 3, RAID 4, RAID 5, or RAID 50 *and* you have one or more drives left, the Number of Spares screen displays.

7 If the Number of Spares screen displays, enter the number of spares you want to add and press **Enter**.

This creates dedicated spares that can only be used by this array. A dedicated spare drive will not be available for any other use.

If you do not want a dedicated spare, enter **0**.

The Select Drives screen displays.

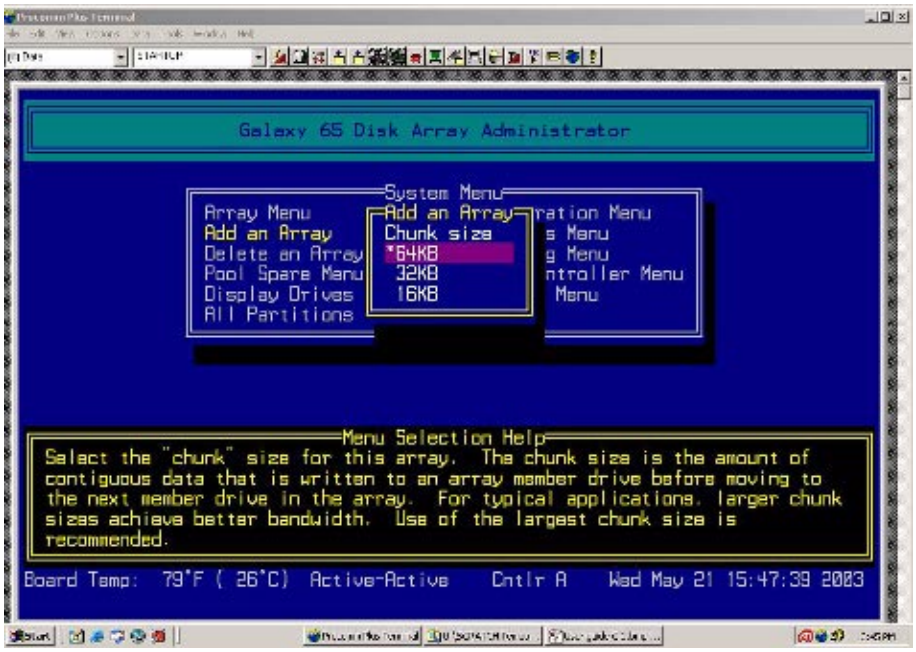
8 If the Select Drives screen displays, select the drive you want to use as a dedicated spare and press **Enter**.

Only available drives, that is, drives that are not members of an array and are not assigned as a dedicated or pool spares, display. You can delete a dedicated spare from the array at any time. For more information, see E.1.2, ”Deleting a Dedicated Spare”, on page 168.

You select a drive by highlighting it and pressing **Enter**. Each selected drive turns gray in the drive list. After you press **Enter** for the number of drives you entered previously, the system automatically goes to the next screen. To skip a drive, use the ↑ or ↓ key.

To toggle the display between the drive model number, serial number, and the node and WWN, press **T**.

If the array you are creating is a RAID 3, RAID 4, RAID 5, RAID 10, or RAID 50, the Chunk Size screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions
Add an Array
Chunk size
*64KB
32KB
16KB
Menu Selection Help
Select the "chunk" size for this array. The chunk size is the amount of contiguous data that is written to an array member drive before moving to the next member drive in the array. For typical applications, larger chunk sizes achieve better bandwidth. Use of the largest chunk size is recommended.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:47:39 2003

9 If the Chunk Size screen displays, select the chunk size and press **Enter**.

The chunk size is the amount of contiguous data that is written to an array member before moving to the next member of the array. To determine the appropriate chunk size, refer to your operating system documentation. For example, the default chunk size for Windows NT and many other operating systems is 64 KB. If you are using the array for a database with very small records, you may want to use a smaller chunk size.

If the array you are creating is a RAID 3, RAID 4, RAID 5, RAID 50, or Mirrored array, the Array Init Options screen displays. The current option has an * next to it.

10 If the Array Init Options screen displays, select the option you want and press **Enter**.

- **Offline Initialization**: Using this option means you must wait for the array initialization process to finish before using the array. It uses the zero method to create the array, which is faster than the verify method.
- **Online Initialization**: Using this option lets you begin using the array immediately after creating it, while the array initialization process runs. It uses the verify method to create the array, which takes longer than the zero method.

The system confirms that you want to create the array.

11 Select **Yes** and press **Enter**.

A message notifies you that the array is being created and shows the progress of the initialization process. The array initialization process takes from several minutes to more than an hour depending on the array type (volume, RAID 0, and RAID 1 are the fastest), array size, drive speed, and other processes running on the Galaxy 65 Subsystem.

You can press **Esc** to return to the Disk Array Administrator menus and perform other functions. To check the progress of the array initialization, select **Array Menu** from the System Menu. The status of the initialization displays in the list of arrays.

If you find that you need to change the disks or some other array configuration, you can stop the array initialization process. See C.2.2, ”Stopping the Array Initialization Process”, on page 120.

You must create at least one partition before you can use the array. See C.2.3, ”Adding a Partition”, on page 121.

Note Most operating systems, such as Windows NT 4.0, require you to restart the host system to see the new array. Windows 2000 can recognize new LUNs by selecting Refresh from the Computer Management Window. NetWare v3.12 and later can recognize new devices by typing the command SCAN FOR NEW DEVICES at the console prompt. Other operating systems might have similar features.

C.2 Managing Arrays

The Disk Array Administrator software lets you manage your arrays in a variety of ways. You can:

- View array and drive status (see C.2.1, ”Viewing Array and Drive Status Information”, on page 117)
- Stop the initialization process (see C.2.2, ”Stopping the Array Initialization Process”, on page 120)
- Add a partition (see C.2.3, ”Adding a Partition”, on page 121)
- Verify an array (see C.2.4, ”Verifying an Array”, on page 123)
- Reconstruct an array (see C.2.5, ”Reconstructing an Array”, on page 126)
- Expand array capacity (see C.3.3, ”Expanding a Partition”, on page 139)
- Change the array name (see C.2.7, ”Changing an Array Name”, on page 129)
- Change array ownership (see C.2.8, ”Changing Array Ownership”, on page 130)
- Trust an array (see C.2.9, ”Trusting an Array”, on page 130)
- Delete an array (see C.2.10, ”Deleting an Array”, on page 131)

C.2.1 Viewing Array and Drive Status Information

Array and drive status information is available in two ways:

- View array status (see page 117)
- View drive status (see page 119)

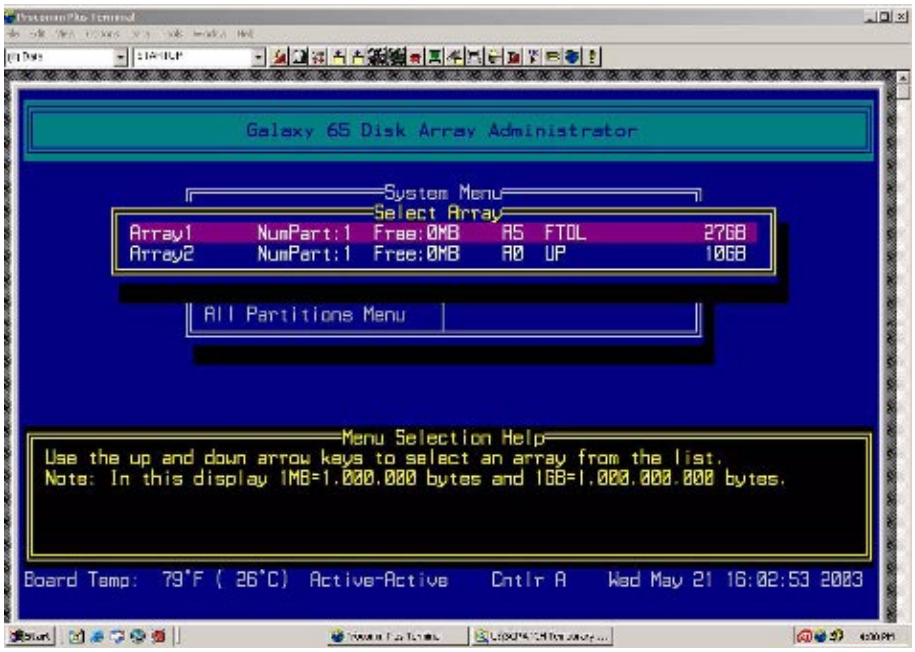
C.2.1.1 Viewing Array Status

You can view the status of an array, including the following information:

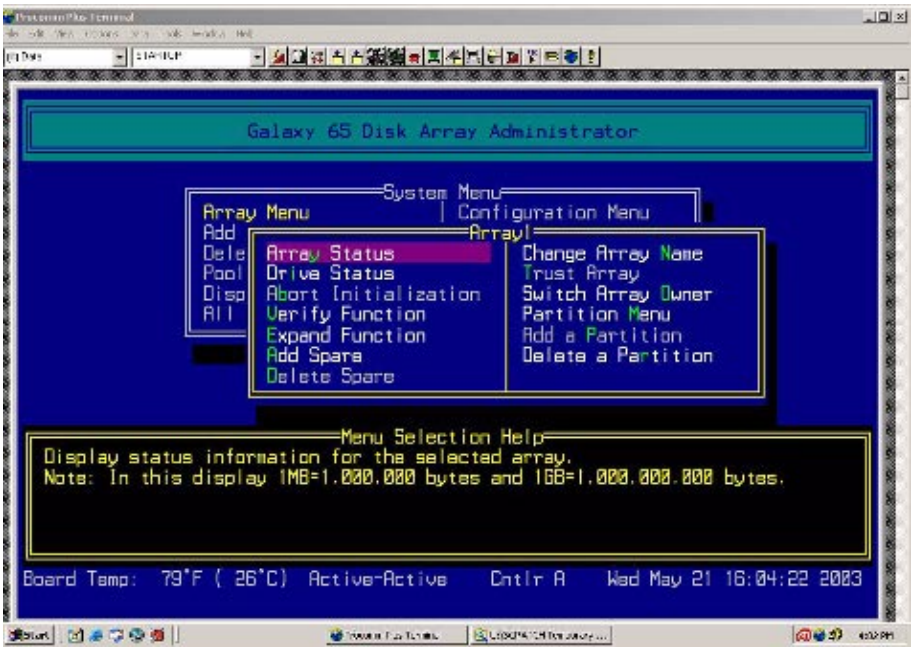
- State: Online, Offline, Critical, or Fault-tolerant.
- Serial number: Unique number the Galaxy 65 Subsystem assigns to each array.
- Name: Name you give to the array.
- RAID level: Array type (0, 3, 4, 5, 50, Volume, or Mirrored). The term “mirrored” is used for both RAID 1 and RAID 10 arrays.
- Number of drives: Number of drives in the array when fault-tolerant. For example, if a three-drive RAID 5 array loses one drive, the number will still display 3.
- Number of drives per subarray: For RAID 50 only; number of drives in each underlying RAID 5 array.
- Number of spare drives: Number of spare drives dedicated to this array.
- Size: Size of the entire array (expressed in MB or GB for arrays larger than 10 GB).
- Chunk size: Array’s chunk size.
- Date created: Date the array was created.
- Utility: Utility running (None, Verify, Reconstruct, Expand, or Initialize).
- Number of partitions: Number of partitions created on the array.
- Free partition total: Amount of free space (no partition) on the array.

To view the status of an array:

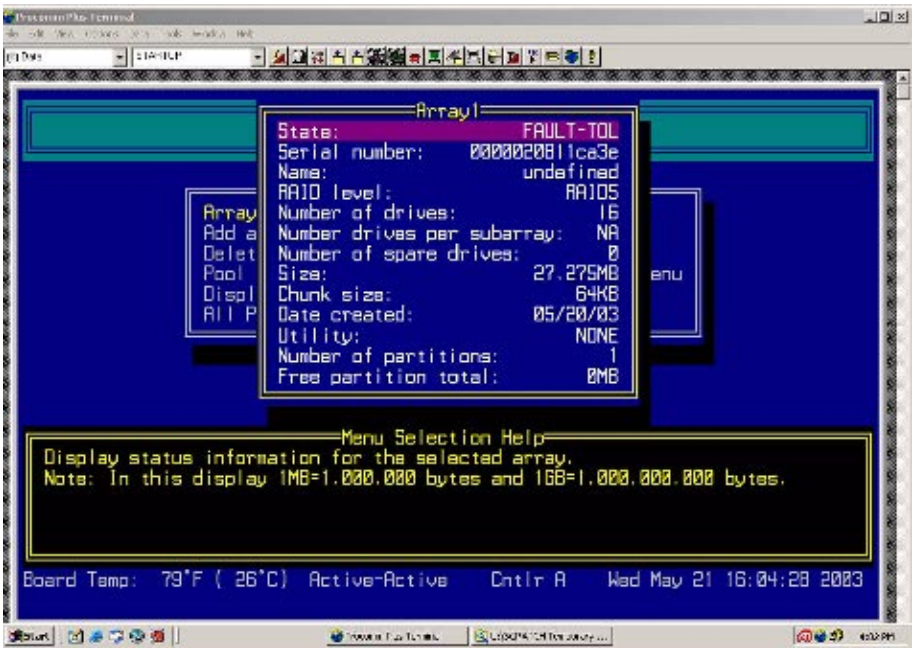
1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.


Galaxy 65 Disk Array Administrator
System Menu
Select Array
Array1 NumPart:1 Free:0MB R5 FTDL 276B
Array2 NumPart:1 Free:0MB R0 UP 10GB
All Partitions Menu
Menu Selection Help
Use the up and down arrow keys to select an array from the list.
Note: In this display 1MB=1,000,000 bytes and 1GB=1,000,000,000 bytes.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 16:02:53 2003

2 Select the array you want and press **Enter**.
The array menu displays.



3 Select **Array Status** and press **Enter**
The status screen displays showing the status of the array you selected.


Array1
State: FAULT-TOL
Serial number: 00000208l1ca3e
Name: undefined
RAID level: RAID5
Number of drives: 16
Number drives per subarray: NA
Number of spare drives: 0
Size: 27.275MB
Chunk size: 64KB
Date created: 05/20/03
Utility: NONE
Number of partitions: 1
Free partition total: 0MB
Menu Selection Help
Display status information for the selected array.
Note: In this display 1MB=1.000.000 bytes and 1GB=1.000.000.000 bytes.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 16:04:28 2003

4 Press **Esc** to return to the Array Menu.

C.2.1.2 Viewing Drive Status

You can view the status of the drives in an array, including the following information:

- Drive number: The drive's sequential position in the Galaxy 65 Subsystem's drive list.
- Drive status: Whether the drive is up or down.
- Spare: SPR identifies the drive as a dedicated spare.
- Channel number: Back-end disk bus number.
- Channel: ID
- Size: Size of the drive in MB.
- Usage: If part of an array, this displays the array name and member number. If a spare, this displays the type of spare. If unused, this displays Available. If the drive was part of an array that no longer exists, this displays Leftover.

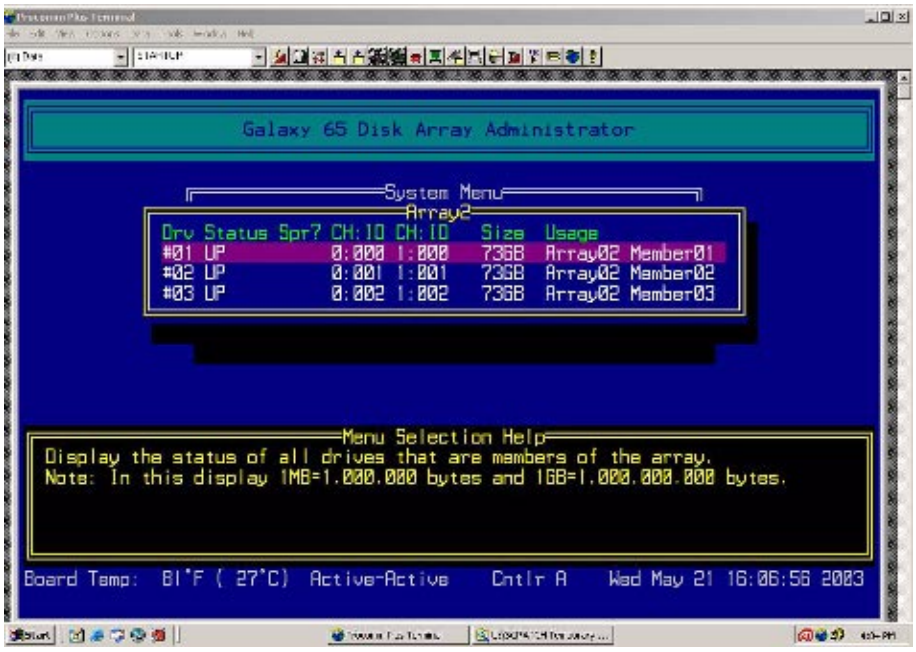
Note If a drive has failed or malfunctioned, it may not be listed.

To view drive status:

1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

2 Select the array you want and press **Enter**.
The array menu displays.

3 Select **Drive Status** and press **Enter**
The drive status screen displays showing the drives that are members of the array and that are assigned as dedicated spares.


Galaxy 65 Disk Array Administrator
System Menu
Array2
Drv Status Spr? CH:ID CH:ID Size Usage
#01 UP 0:000 1:000 73GB Array02 Member01
#02 UP 0:001 1:001 73GB Array02 Member02
#03 UP 0:002 1:002 73GB Array02 Member03
Menu Selection Help
Display the status of all drives that are members of the array.
Note: In this display 1MB=1,000,000 bytes and 1GB=1,000,000,000 bytes.
Board Temp: 81°F (27°C) Active-Active Cntlr A Wed May 21 16:06:56 2003

Use the ↑ or ↓ key to scroll through the drives. These are the drives that are currently members of the array.

4 Press **Esc** to return to the Array Menu.

C.2.2 Stopping the Array Initialization Process

If you find that you need to change the disks or some other array configuration, you can stop the array initialization process.

Caution *If you stop the initialization process, the array goes offline and its data is not available to users.*

You must delete the array before you can use the drives in another array.

To stop the array initialization process:

1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

2 Select the array you want and press **Enter**.
The array menu displays.

3 Select **Abort Initialization** and press **Enter**
The system confirms that you want to stop the initialization process.

4 Select **Yes** and press **Enter**.

C.2.3 Adding a Partition

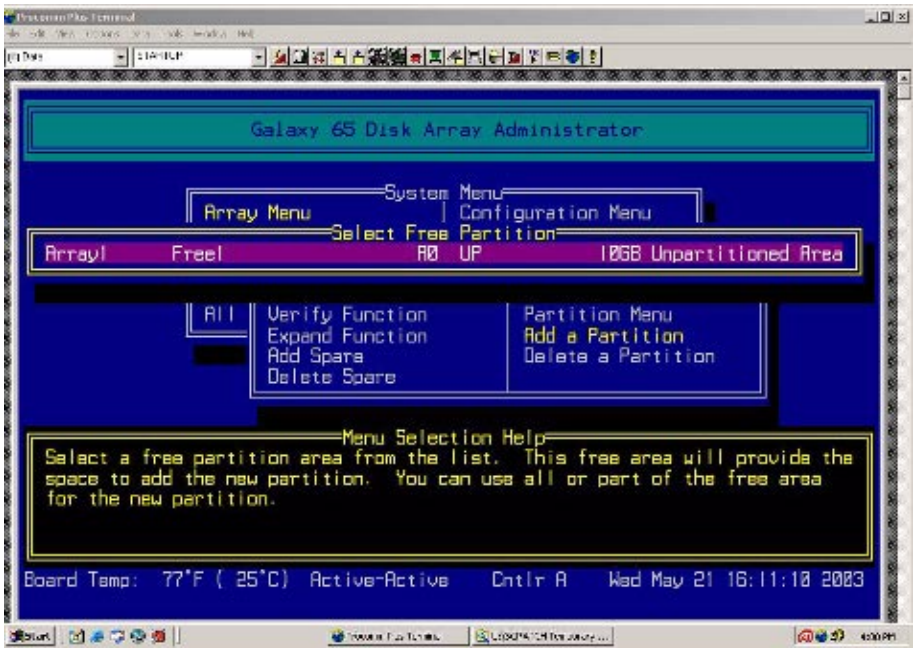
If you created a multiple-partition array, you must create at least one partition on the array before you can use the array. You can create partitions on a multiple-partition array until you use all of the free space. For more information about partitions, see C.3.1, ”Understanding Partitions”, on page 133.

To add a partition:

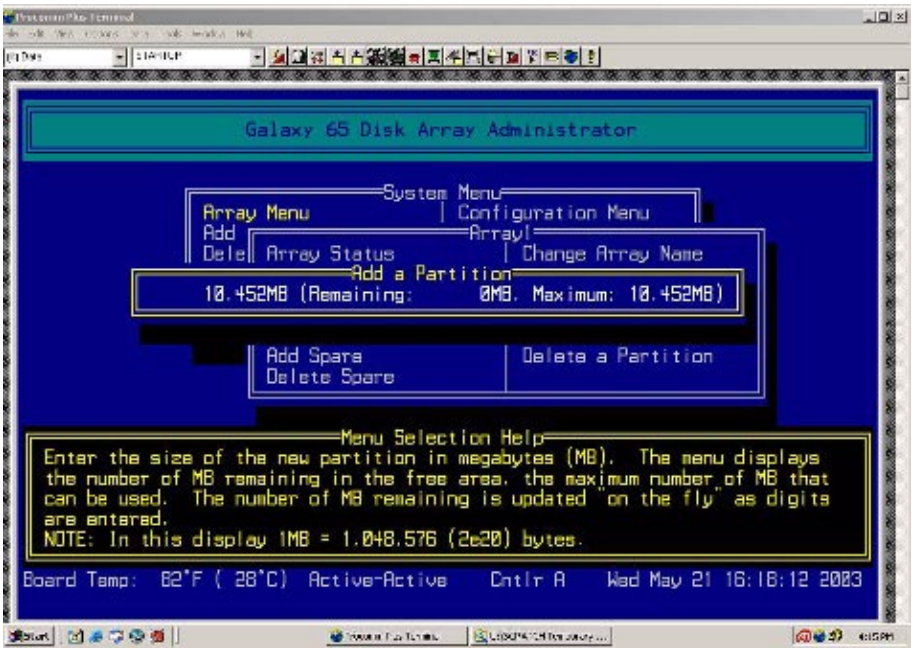
1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

2 Select the multiple-partition array you want and press **Enter**.
The array menu displays.

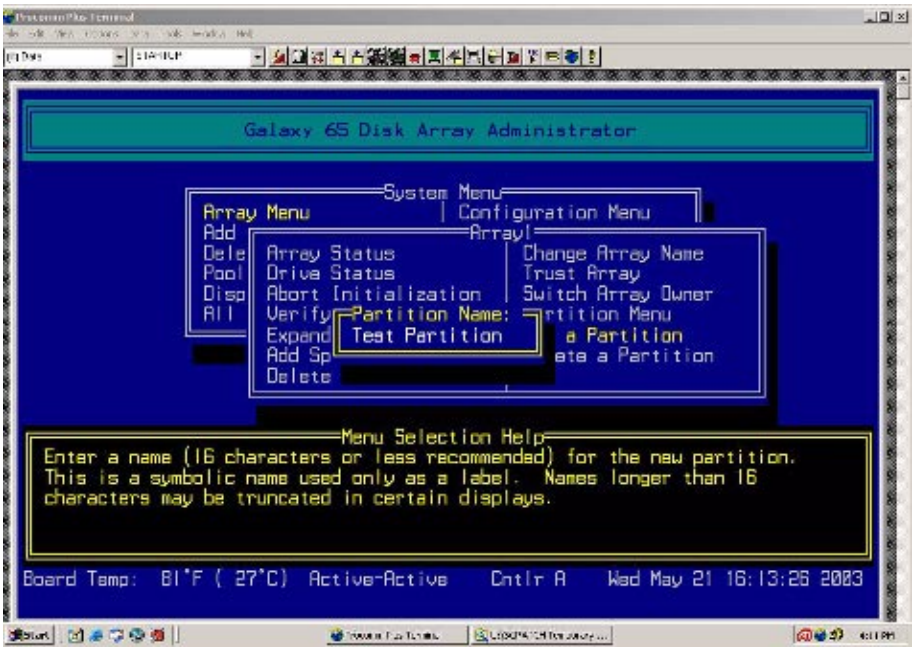
3 Select **Add a Partition** and press **Enter**.
The Select Free Partition screen displays with a list of free partitions. A free partition is free space that has not yet been partitioned or space that had a partition that was deleted.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Configuration Menu
Select Free Partition
Array1 Free1 A0 UP 10GB Unpartitioned Area
All
Verify Function
Expand Function
Add Spare
Delete Spare
Partition Menu
Add a Partition
Delete a Partition
Menu Selection Help
Select a free partition area from the list. This free area will provide the space to add the new partition. You can use all or part of the free area for the new partition.
Board Temp: 77°F (25°C) Active-Active Cntlr A Wed May 21 16:11:10 2003

4 Select the free partition you want to use.
The partition size screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Configuration Menu
Add
Array!
Dele
Array Status
Change Array Name
Add a Partition
10.452MB (Remaining: 0MB. Maximum: 10.452MB)
Add Spare
Delete Spare
Delete a Partition
Menu Selection Help
Enter the size of the new partition in megabytes (MB). The menu displays the number of MB remaining in the free area, the maximum number of MB that can be used. The number of MB remaining is updated "on the fly" as digits are entered.
NOTE: In this display 1MB = 1,048,576 (2e20) bytes.
Board Temp: 82°F (28°C) Active-Active Cntlr A Wed May 21 16:18:12 2003

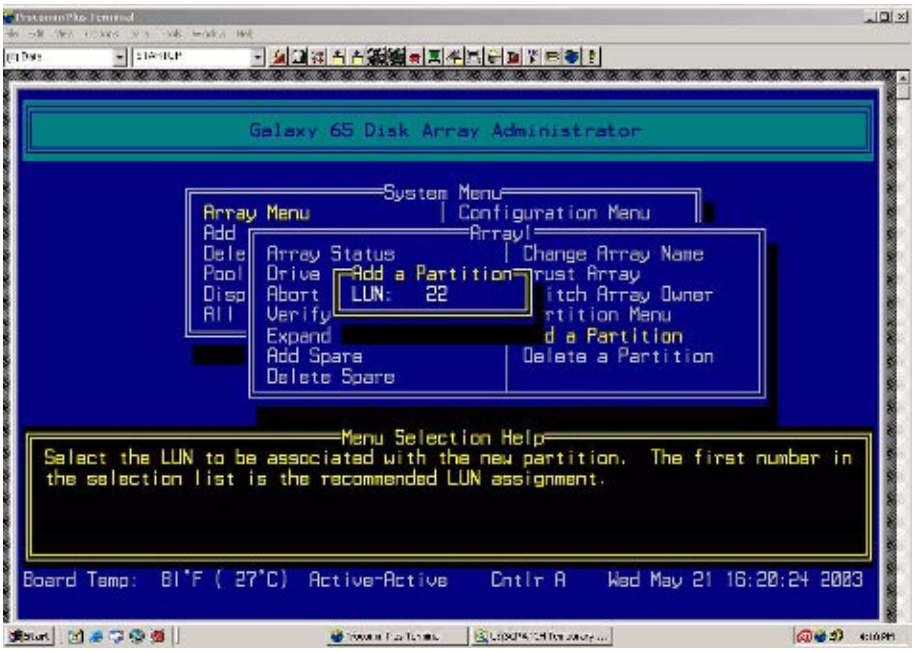
5 Enter the size you want to make the partition and press **Enter**.
The Partition Name screen displays.



6 Enter a name for the partition and press **Enter**.

You can use up to 20 characters. You can include any characters in the name, including spaces. If you do not want to name the partition, you can just press **Enter**. You can add or change the name later.

The LUN screen displays.



7 Select the LUN for the partition and press **Enter**.
The LUN that displays is the suggested default LUN assignment.

Note Most UNIX, Linux, and Macintosh operating systems require that the CAPI LUN, which is the LUN assigned to each SM, be set to a higher value than all array LUNs. Before creating your first array, change the CAPI LUN to a higher value. If you are using a custom software application to configure and manage the Galaxy 65 subsystem (this application uses CAPI to communicate with the Galaxy 65), you must have a CAPI LUN. If you are not using a custom application, and therefore are not using CAPI, select NONE as the CAPI LUN. This allows your first array to be seen at LUN 0.

The system warns you about the LUN for UNIX and Macintosh, as above, the first time you create a partition. Press **Enter** and the system asks if you want to be warned again. Select **No** to avoid receiving this warning again, otherwise select **Yes** to be warned the next time you create a partition.

The system confirms that you want to make the change.

8 Select **Yes** and press **Enter**.

C.2.4 Verifying an Array

The Verify function allows you to verify the data on the specified array (RAID 3, RAID 4, RAID 5, RAID 50, and mirrored arrays only):

- *RAID 3, RAID 4, RAID 5 and RAID 50:* Verifies all parity blocks in the selected array and corrects any bad parity.
- *Mirrored*: Compares the primary and secondary drives. If a mismatch occurs, the primary is copied to the secondary.

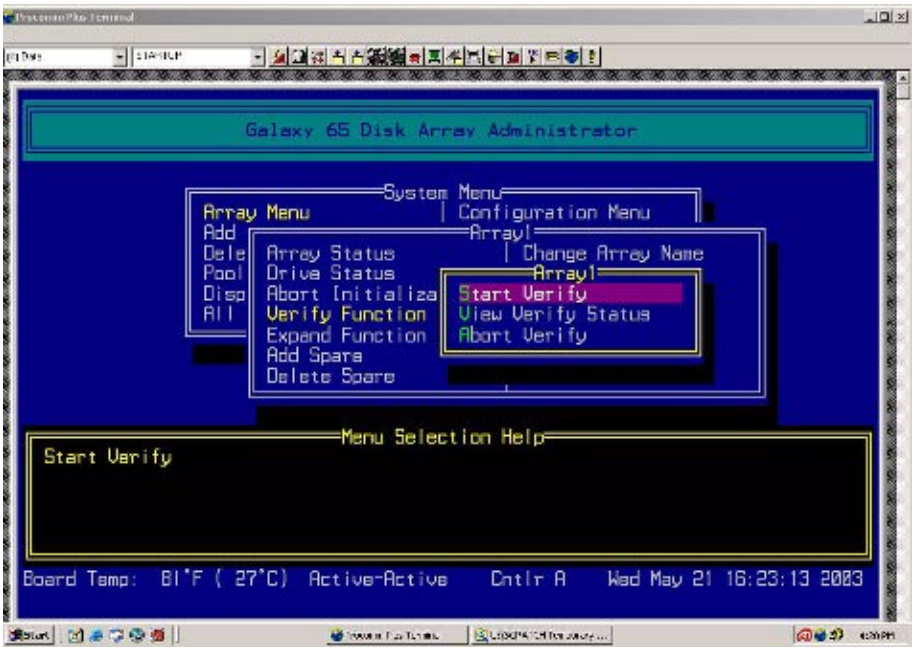
You may want to verify an array when you suspect there is a problem.

To verify an array:

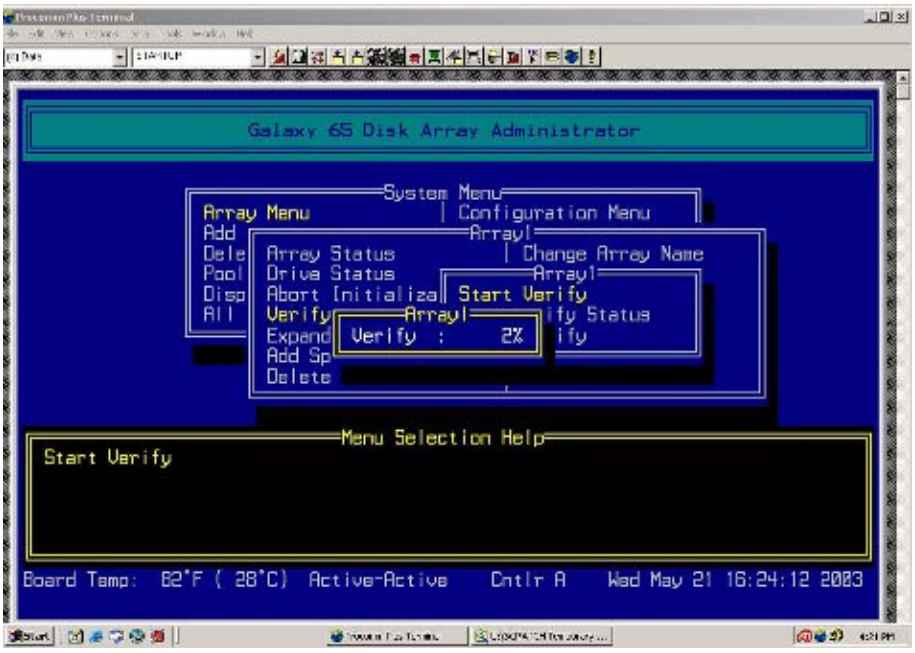
1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

2 Select the array you want and press **Enter**.
The array menu displays.

3 Select **Verify Function** and press **Enter**
The verify menu displays.



4 Select **Start Verify** and press **Enter**
Verification begins and the percentage of verification completed displays. You can continue to use the array during verification.



To return to the verification menu, press **Esc**. To check the progress of the array verification, you can use the verification status described below or select **Array Menu** from the System Menu. The status of the verification displays in the list of arrays.

C.2.4.1 Viewing Verification Status

You can view the status of the verification process while it is running.

To view verification status:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press **Enter**.
   The array menu displays.

3. Select **Verify Function** and press **Enter**
   The verify menu displays.

4. Select **View Verify Status** and press **Enter**
   The verify menu displays.

5. Press **Esc** to return to the verify menu.

C.2.4.2 Stopping the Verification

You can stop the verification process. Normally, you want to let the verification finish, although stopping it does *not* cause any damage to your data. You may want to stop the verification if you want to improve performance of the Galaxy 65 Subsystem for another application.

To stop the verification process:

1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

2 Select the array you want and press **Enter**.
The array menu displays.

3 Select **Verify Function** and press **Enter**
The verify menu displays.

4 Select **Abort Verify** and press **Enter**.

The system confirms that you want to stop the verification process.

5 Select **Yes** and press **Enter**.

C.2.5 Reconstructing an Array

.The Galaxy 65 Subsystem automatically reconstructs redundant arrays (RAID 3, RAID 4, RAID 5, RAID 50, and mirrored) if an array becomes critical and a properly sized spare drive is available. An array becomes critical when one or more member drives fail.

If a reconstruct does not start automatically, it means that no valid spares are available. To start a reconstruct, replace the failed drive, and add the new drive as a dedicated spare (see E.1.1, ”Adding a Dedicated Spare”, on page 168 and E.2, ”Enabling Dynamic Spares”, on page 169) or as a pool spare (see E.3.1, ”Adding a Spare to the Spare Pool”, on page 171). Remember that any pool spares added might be used by any critical array, not necessarily the array you want.

C.2.6 Expanding Array Capacity

You can expand array capacity without stopping I/O activity, so you can continue using the array while the expansion process runs. You can only expand one array at a time.

Notes

1 Expanding an array here does not change the size of the host operating system partitions that reside on the array, because the RAID controller is working at the block level not the file system level of the operating system. To use the new space, you must create a new operating system partition using the newly added space or use a third-party application specific to the operating system to change the partition size.

2 How you create a new partition or resize an existing one depends upon the operating system. Most operating systems cannot resize an existing partition. Refer to your operating system documentation.

The number of drives you can add to an array depends upon the RAID level as shown in Table 3–2. You also cannot exceed the maximum number of drives for each RAID level. See C.1, ”Creating Arrays”, on page 105.

Table 3–2 Drive additions by RAID level

RAID level	Number of drives you can add	Maximum number of drives
RAID 0	1 to 4 at a time up to the maximum	16
RAID 1 (Mirrored)	Cannot expand	N/A
Volume Set	Cannot expand	N/A
RAID 10	2 or 4 at a time up to the maximum	16
RAID 3, 4, or 5	1 to 4 at a time up to the maximum	16
RAID 50	You can expand the array, one RAID 5 array at a time up to the maximum number of drives. All RAID 5 arrays must contain the same number of drives.	32

If you are expanding a multiple-partition array, you add free space at the end of the array. For more information about partitions, see C.3.1, ”Understanding Partitions”, on page 133.

Note Once you start expanding array capacity, you cannot stop it. The expand function may take an hour or more to complete, depending on the array type, array size, drive speed, and other processes running on the Galaxy 65 Subsystem.

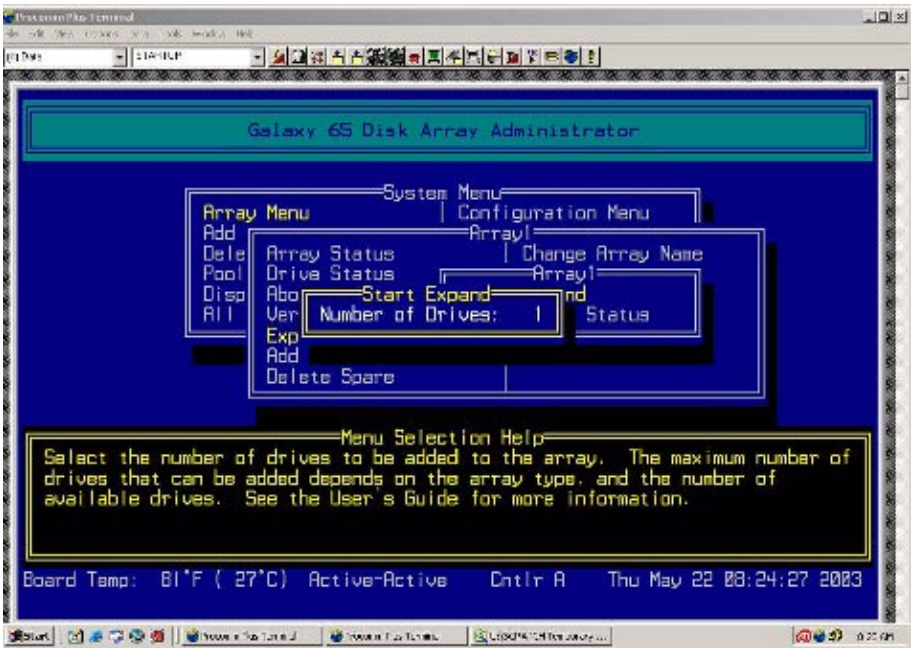
To expand an array:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.

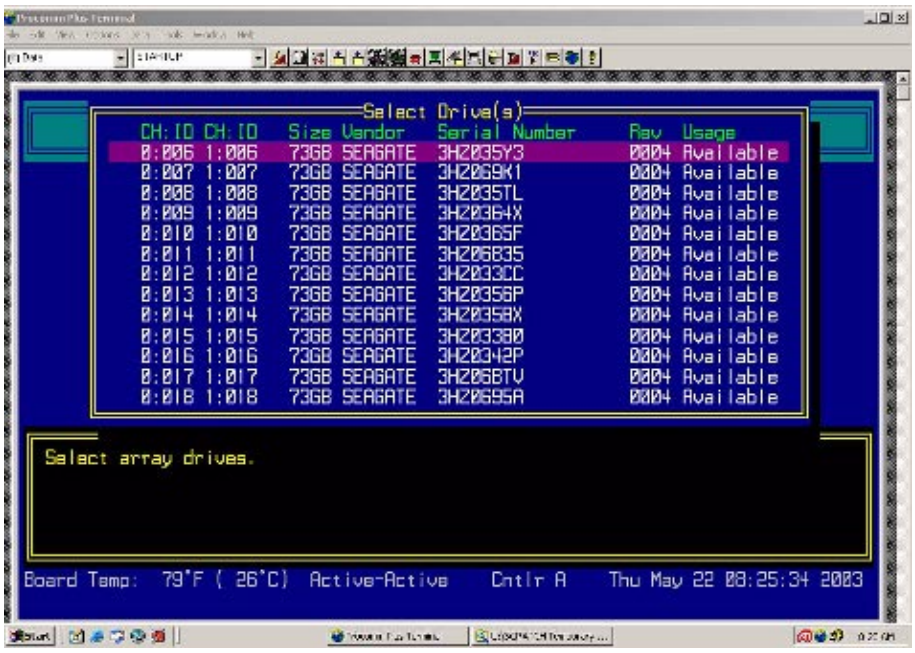
2. Select the array you want and press **Enter**.
   The array menu displays.

3. Select **Expand Function** and press **Enter**
   .The expand menu displays.

4. Select **Start Expand** and press **Enter**
   The Number of Drives screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Configuration Menu
Array1
Array Status
Change Array Name
Drive Status
Start Expand
Number of Drives: 1
Status
Delete Spare
Menu Selection Help
Select the number of drives to be added to the array. The maximum number of drives that can be added depends on the array type, and the number of available drives. See the User's Guide for more information.
Board Temp: 81°F (27°C) Active-Active Cntlr A Thu May 22 08:24:27 2003

5 Enter the number of drives you want to add and press **Enter**.
The Select Drives screen displays.


Select Drive(s)
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Available
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Available
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Available
0:009 1:009 73GB SEAGATE 3HZ03G4X 0004 Available
0:010 1:010 73GB SEAGATE 3HZ0365F 0004 Available
0:011 1:011 73GB SEAGATE 3HZ06835 0004 Available
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Available
0:013 1:013 73GB SEAGATE 3HZ0356P 0004 Available
0:014 1:014 73GB SEAGATE 3HZ0358X 0004 Available
0:015 1:015 73GB SEAGATE 3HZ03380 0004 Available
0:016 1:016 73GB SEAGATE 3HZ034Z2P 0004 Available
0:017 1:017 73GB SEAGATE 3HZ06BTV 0004 Available
0:018 1:018 73GB SEAGATE 3HZ0695A 0004 Available
Select array drives.
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:25:34 2003

6 Select the drives you want to add from the list of available drives and press **Enter**.
Only available drives, that is, drives that are not members of an array and are not assigned as dedicated or pool spares, display.

You select a drive by highlighting it and pressing **Enter**. Each selected drive turns gray in the drive list. After you press **Enter** for the number of drives you entered previously, the system automatically begins the expansion. To skip a drive, use the ↑ or ↓ key.

To toggle the display between the drive model number, serial number, and the node and WWN, press **T**.

Expansion begins and the percentage completed displays. to return to the array menu, press **Esc**. To check the progress of the expansion, you can use the expand status described below or select **Array Menu** from the System Menu. The status of the expansion displays in the list of arrays.

C.2.6.1 Viewing Expand Status

You can view the status of the expansion process while it is running.

To view expand status:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press **Enter**.
   The array menu displays.
3. Select **Expand Function** and press **Enter**
   The expand menu displays.
4. Select **View Expand Status** and press **Enter**
   The Expand Status screen displays.
5. Press **Esc** to return to the expand menu.

C.2.7 Changing an Array Name

You can change the name of an array. This does not affect the target ID or LUN values of the array. The Galaxy 65 Subsystem does not allow you to change an array name when a utility is running.

To change an array name:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press **Enter**.
   The array menu displays.
3. Select **Change Array Name** and press **Enter**
   The Enter New Name screen displays.
4. Enter the name you want to use and press **Enter**.

   You can use up to 20 characters. You can include any characters in the name, including spaces.

   The system confirms that you want to make the change.

5 Select **Yes** and press **Enter**.

C.2.8 Changing Array Ownership

You can change the ownership of any array between the SMs.

You might want to change ownership if you plan to replace or repair one SM. Changing ownership lets you continue using an array without interruption and makes the array visible on the SM you change it to. You can no longer see the array on the original SM.

Note When you change the ownership of an array, the LUNs assigned to the array's partitions become invalid. After changing ownership, you must assign a new LUN to each array partition.

To change array ownership:

1 From the System Menu, select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

2 Select the array you want and press **Enter**.
The array menu displays.

3 Select **Switch Array Owner** and press **Enter**
The system confirms that you want to make the change.

4 Select **Yes** and press **Enter**.
Assign a new LUN to each array partition.

5 See C.3.5, "Changing a Partition LUN", on page 141.

C.2.9 Trusting an Array

You can use the Trust Array function to bring an array back online by re synchronizing the time and date stamp and any other metadata on a bad disk. This makes the disk an active member of the array again. You might need to do this when:

- One or more disks of an array start up more slowly or were powered on after the rest of the disks in the array. This causes the date and time stamps to differ, which the Galaxy 65 Subsystem interprets as a problem with the "late" disks. In this case, the array will function normally after using Trust Array.
- An array is offline because a drive is failing, you have no data backup, and you want to try to recover the data from the array. In this case, the Trust Array function may work, but only as long as the failing drive continues to operate.

Before you can use this function, you must enable it in the Option Configuration menu.

Caution *The Trust Array feature can cause unstable operation and data loss if used improperly. This feature is intended for disaster recovery.*

To trust an array:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Option Configuration** and press **Enter**.
The Option Configuration Menu displays.

3 Select **Enable Trust Array** and press **Enter**
The Enable Trust Array screen displays.

4 Select **Enable** and press **Enter**.
The option is only enabled until you use it. After you trust an array, the option reverts back to being disabled.

5 Press **Esc** twice to return to the System Menu.

6 Select **Array Menu** and press **Enter**.
The Select Array screen displays with a list of existing arrays.

7 Select the array you want and press **Enter**.
The array menu displays.

8 Select **Trust Array** and press **Enter**.
The system confirms that you want to trust the array.

9 Select **Yes** and press **Enter**.
The array will be back online.

Note If the array does not come back online, it may be that too many members are offline or the array may have additional failures on the bus or enclosure that Trust Array cannot fix.

C.2.10 Deleting an Array

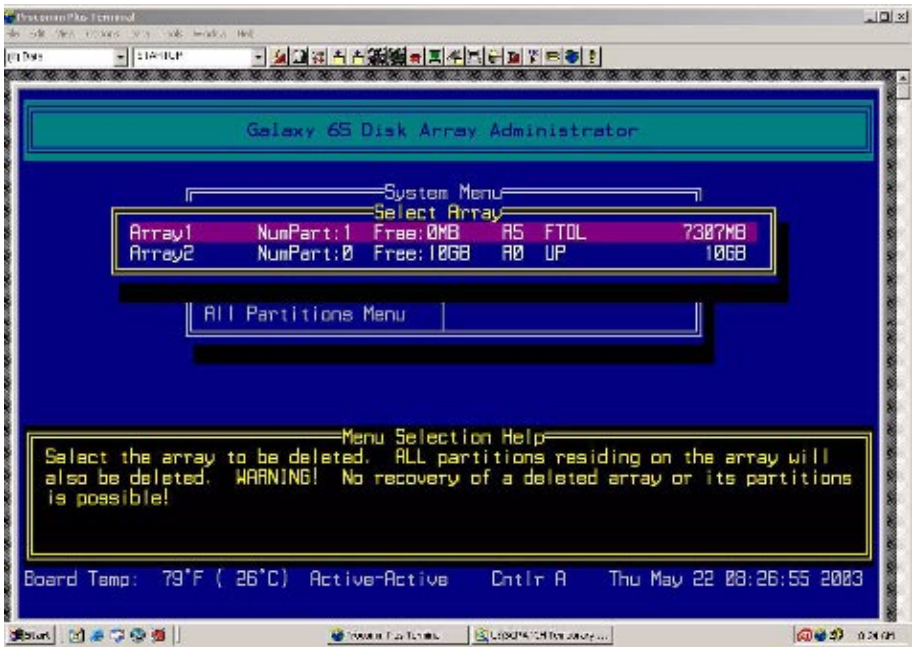
You can delete an array when you no longer need the array or you need the drives for another use.

Caution *Deleting an array deletes all partitions and data contained in the array.*

Note You cannot delete an array while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the array.

To delete an array:

1 From the System Menu, select **Delete an Array** and press **Enter**
The Select Array screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Select Array
Array1 NumPart:1 Free:0MB A5 FTOL 7307MB
Array2 NumPart:0 Free:10GB A0 UP 10GB
All Partitions Menu
Menu Selection Help
Select the array to be deleted. ALL partitions residing on the array will also be deleted. WARNING! No recovery of a deleted array or its partitions is possible!
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:26:55 2003

2 Select the array you want to delete and press **Enter**.
The system asks you to confirm the deletion.

3 Select **Yes** and press **Enter**.

C.3 Managing Partitions

The Disk Array Administrator software lets you manage partitions in a variety of ways. You can:

- View partition status information (see page 117)
- Add a partition (see page 121)
- Expand a partition (see page 139)
- Change a partition name (see page 140)
- Change a partition LUN (see page 141)
- Change a partition's read-ahead setting (see page 142)
- Control partition access (see page 144)
- Delete a partition (see page 151)

C.3.1 Understanding Partitions

The partitions discussed here are logical subdivisions of an array to which you can assign a LUN. You can add, expand, rename, change the LUN, and delete partitions using the RAID controller's software. This type of partition is *not* the same as a partition you create with your operating system or third party tools.

When you create an array, you can choose to make the array all one partition or set up the array for multiple partitions. Using multiple partitions lets you create one very large array making efficient use of your disk drives. For example, you could create one very large RAID 5 array and assign one dedicated spare to the array. This minimizes the amount of disk space allocated to parity and spares compared to the space required if you created five or six smaller RAID 5 arrays.

Once you set up an array for multiple partitions, you must create each partition by setting the partition size and assigning the partition a LUN. You can also give each partition a name. We recommend assigning names that indicate how the partition will be used. For example, if the first partition will be used to store your customer database, give it a name like: cust database.

When you first create an array set up for multiple partitions, all of the space on the array is designated as free space as shown in Figure 3–1.

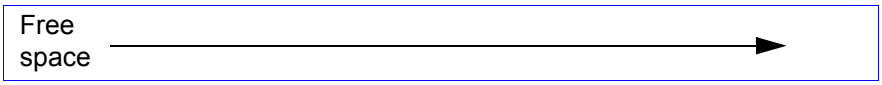


Figure 3–1 Array set up for multiple partitions before creating partitions

When you create a partition, you set how large you want the partition to be in MB. Figure 3–2 shows a single partition.

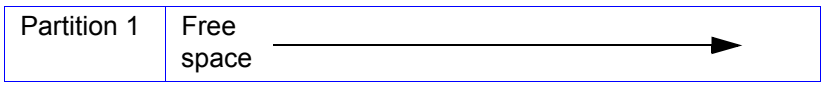


Figure 3–2 Array after creating one partition

The Disk Array Administrator assigns each partition a unique serial number and sequence number. It assigns sequence numbers in the order the partitions are created, so the first partition on an array is number 1, the second is 2, and so on. Once you create one or more partitions on an array, you can create additional partitions in the remaining free space or you can expand a partition with some limitations.

You can only expand a partition into contiguous, following, free space. In Figure 3–2, you can expand partition 1 or you can create additional partitions in the free space.

After you partition all of the free space, you can expand the size of a partition only by deleting a partition that follows (has a higher number than) the one you want to expand. In Figure 3–3, you can delete partition 3 and then expand partition 2 to use some or all of partition 3's space.

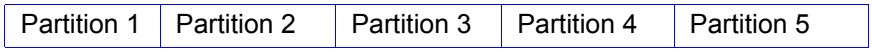


Figure 3–3 Array after creating five partitions

Caution *If you delete a partition, you also delete all data stored in the partition. Be sure that you back up all data before deleting a partition.*

When you expand an array, you add free space at the end of the array as shown in Figure 3–4. For more information about expanding an array, see C.2.6, "Expanding Array Capacity", on page 126.

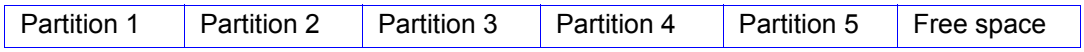


Figure 3–4 Array with five partitions after expanding the array

After expanding an array, you can either add a partition or expand the last partition to use the new free space. You can also delete one or more partitions and expand a partition into the space.

C.3.2 Viewing Partition Status Information

You can perform three functions related to partition status information:

- View partition status (see page 134)
- View partition statistics (see page 136)
- Reset partition statistics (see page 138)

C.3.2.1 Viewing Partition Status

You can view the status of a partition, including the following information:

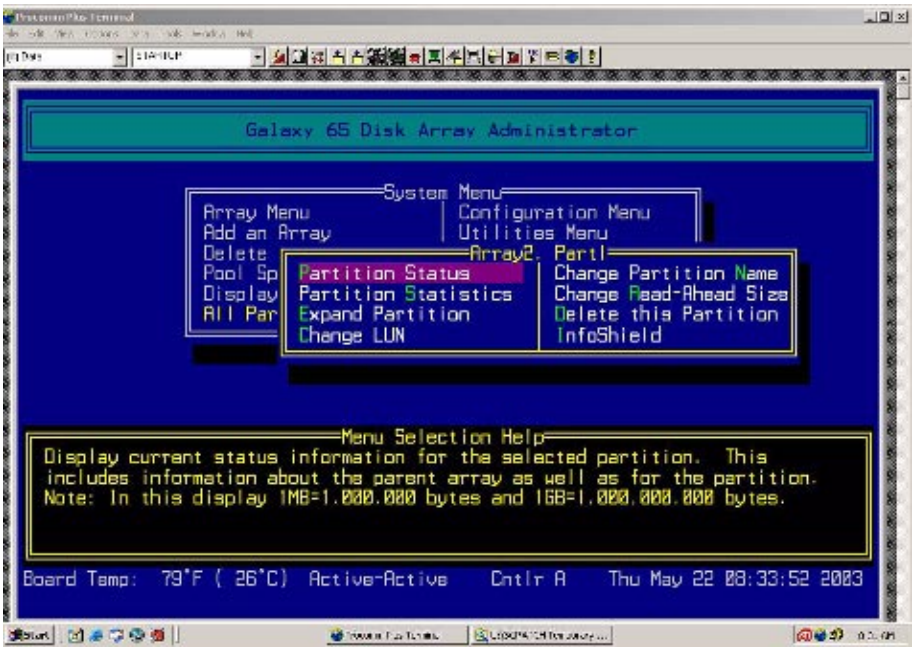
- *Array state*: Online, Offline, Critical, or Fault-tolerant.
- *Array type: RAID level (0, 3, 4, 5, 50, Volume, or Mirrored)*. The term "mirrored" is used for both RAID 1 and RAID 10 arrays.
- *Array drives*: Number of drives in the array when fault-tolerant. For example, if a three-drive RAID 5 array loses one drive, the number will still display 3.
- *Name*: Name you give to the partition.
- *Serial number*: Unique number the Galaxy 65 Subsystem assigns to each partition.
- *Target ID:LUN*: Target ID and LUN presented to the host system.
- *Partition size*: Size of the partition (expressed in MB).

- *Percentage of total array*: The percentage of the total array that this partition represents.
- *Write-back caching*: Status of the write-back cache (enabled or disabled) for this array.
- *InfoShield Type*: Type of InfoShield set up on the partition. See C.3.8, ”Controlling Partition Access”, on page 144.

To view the status of a partition:

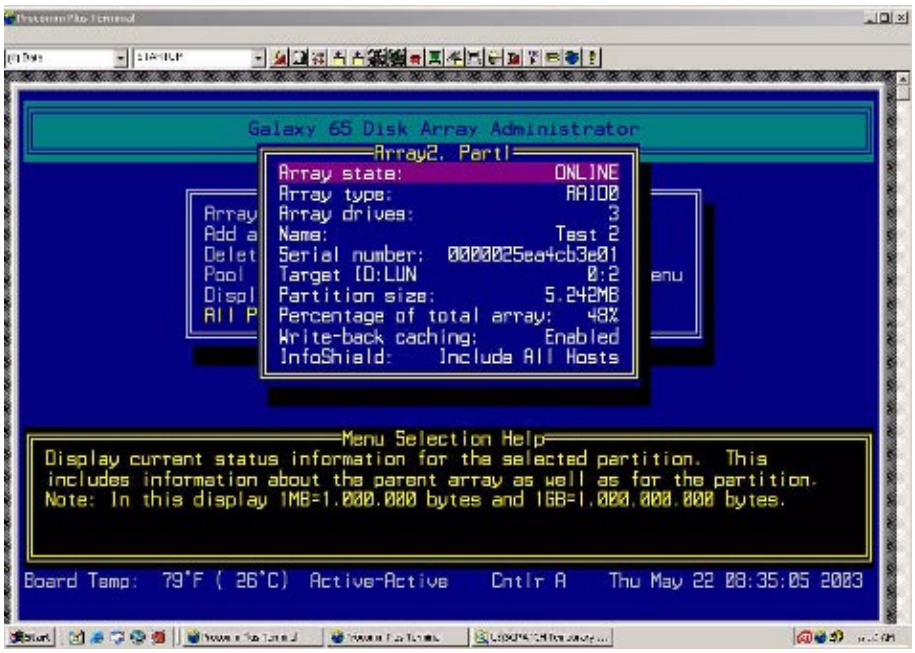
1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.



2 Select **Partition Status** and press **Enter**.

The status screen displays showing the status of the partition you selected.


Galaxy 65 Disk Array Administrator
Array2, Part1
Array state: ONLINE
Array type: RAID0
Array drives: 3
Name: Test 2
Serial number: 0000025ea4cb3e01
Target ID:LUN 0:2
Partition size: 5.242MB
Percentage of total array: 48%
Write-back caching: Enabled
InfoShield: Include All Hosts
Menu Selection Help
Display current status information for the selected partition. This includes information about the parent array as well as for the partition.
Note: In this display 1MB=1,000,000 bytes and 1GB=1,000,000,000 bytes.
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:35:05 2003

3 Press **Esc** to return to the partition menu.

C.3.2.2 Viewing Partition Statistics

You can view the current partition statistics. The following statistics are available:

- *Read*: Total number of host read requests directed to the partition
- *Write*: Total number of host write requests directed to the partition
- *SecRd*: Total number of sectors read from the partition
- *SecWt*: Total number of sectors written to the partition
- *Queue Depth*: Current number of commands from the host that are queued up
- *I/O Size*: Last host I/O block size request in 512-byte sectors

Similar statistics are also available on an aggregate basis for all partition LUNs. For more information, see D.7, ”Displaying Overall Statistics”, on page 165.

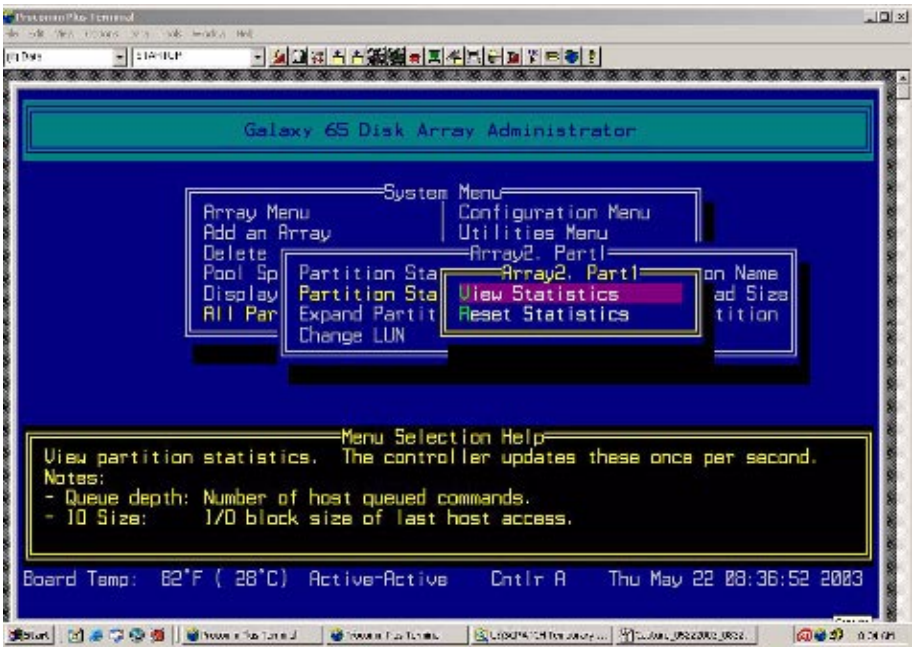
To view the partition statistics:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

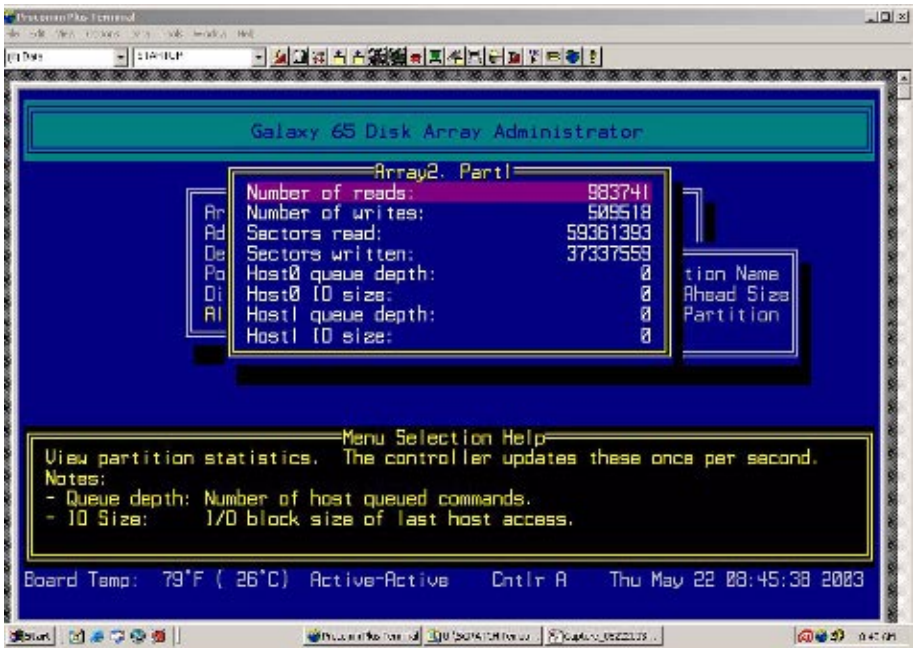
2 Select **Partition Statistics** and press **Enter**.

The statistics menu displays.



3 Select **View Statistics** and press **Enter**.

The statistics screen displays showing the statistics of the partition you selected.


Galaxy 65 Disk Array Administrator
Array2. Part1
Number of reads: 983741
Number of writes: 505518
Sectors read: 59361393
Sectors written: 37337559
Host0 queue depth: 0
Host0 IO size: 0
Host1 queue depth: 0
Host1 IO size: 0
tion Name
Ahead Size
Partition
Menu Selection Help
View partition statistics. The controller updates these once per second.
Notes:
- Queue depth: Number of host queued commands.
- IO Size: I/O block size of last host access.
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:45:38 2003

4 Press **Esc** to return to the statistics menu.

C.3.2.3 Resetting Partition Statistics

You can reset the following partition statistics to zero:

- Read
- Write
- SecRd
- SecWt
- I/O Size

Note Resetting statistics here also resets the statistics for this partition that are included in the aggregate statistics. See D.7, ”Displaying Overall Statistics”, on page 165.

You may want to reset the statistics if you are monitoring performance or doing benchmark testing. You may also want to reset statistics when you change how you are using the partition.

Note You cannot reset the queue depth value. It always reflects the current I/O queue depth.

To reset partition statistics:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**.The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**.The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Partition Statistics** and press **Enter**.

The statistics menu displays.

3 Select **Reset Statistics** and press **Enter**.

The system confirms that you want to make the change.

4 Select **Yes** and press **Enter**.

The system confirms that the statistics have been cleared and returns to the statistics menu.

C.3.3 Expanding a Partition

You can expand an existing partition, with some limitations. You can only expand a partition into contiguous, following, free space. For more information about partitions, see C.3.1, ”Understanding Partitions”, on page 133.

To expand a partition:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Expand Partition** and press **Enter**.
The Expand Partition screen displays.

3 Enter the size you want to make the partition and press **Enter**.

You can only expand a partition into contiguous free space that follows the partition. For more information, see C.3.1, ”Understanding Partitions”, on page 133.

The system confirms that you want to make the change.

4 Select **Yes** and press **Enter**.

C.3.4 Changing a Partition Name

You can change the name of a partition. This does not affect the target ID or LUN values of the partition. The Galaxy 65 Subsystem does not allow you to change a partition name when a utility is running.

To change a partition name:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Change Partition Name** and press **Enter**.
The Enter New Name screen displays.

3 Enter the name you want to use and press **Enter**.

You can use up to 20 characters. You can include any characters in the name, including spaces.

The system confirms that you want to make the change.

4 Select **Yes** and press **Enter**.

C.3.5 Changing a Partition LUN

You can change the LUN assigned to a partition, as it appears under the Galaxy 65 Subsystem's target ID from the host system's point of view. The change takes place immediately, however, you may need to restart the host system to see the partition at the new LUN.

Note You cannot change the partition's LUN to one that is already in use. If you want to use a LUN that is already in use, you must first reassign the LUN in use.

For more information about LUNs and your Galaxy 65 Subsystem, see G.4, "Understanding LUNs and Viewing LUN Information", on page 196.

To change a partition LUN:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Change LUN** and press **Enter**
The New LUN screen displays.

3 Enter the LUN you want to use and press **Enter**.
The system confirms that you want to make the change.

4 Select **Yes** and press **Enter**.

C.3.6 Changing the Read-Ahead Cache Size

You can change the read-ahead cache setting for each partition. This setting controls how much data the Galaxy 65 reads ahead and stores in its cache memory during sequential reads.

If you want to change this size, you should be prepared to monitor the system performance using the array statistics and adjust the size until you find the optimal size for your application.

The default setting is one chunk for the first access in a sequential read and one stripe for all subsequent accesses. The size of the chunk is based on the chunk size used when you created the array (default is 64 kb). The Storage Managers treat volumes and mirrored arrays (RAID 1) internally as if they have a stripe size of 64 kb, even though they are not striped.

If you specify a read-ahead cache size, that amount of data is read first, and the same amount is read for all read-ahead accesses.

Read-ahead is triggered by two back-to-back accesses to consecutive logical block address (LBA) ranges. Read-head can be forward (that is, increasing LBAs) or reverse (that is, decreasing LBAs).

Setting the read-ahead size to 0 turns off read-ahead cache. This is useful if the host is triggering read-ahead for what are random accesses. This can happen if the host breaks up the random I/O into two smaller reads, triggering read-ahead. You can use the partition statistics read histogram to determine what size accesses the host is doing.

Setting the read-ahead size to a very large size (say four to five stripes worth) can help improve the performance of multiple (three or more) sequential read streams, in some cases improving performance by three times. This would be useful for providing multiple video streams, for example.

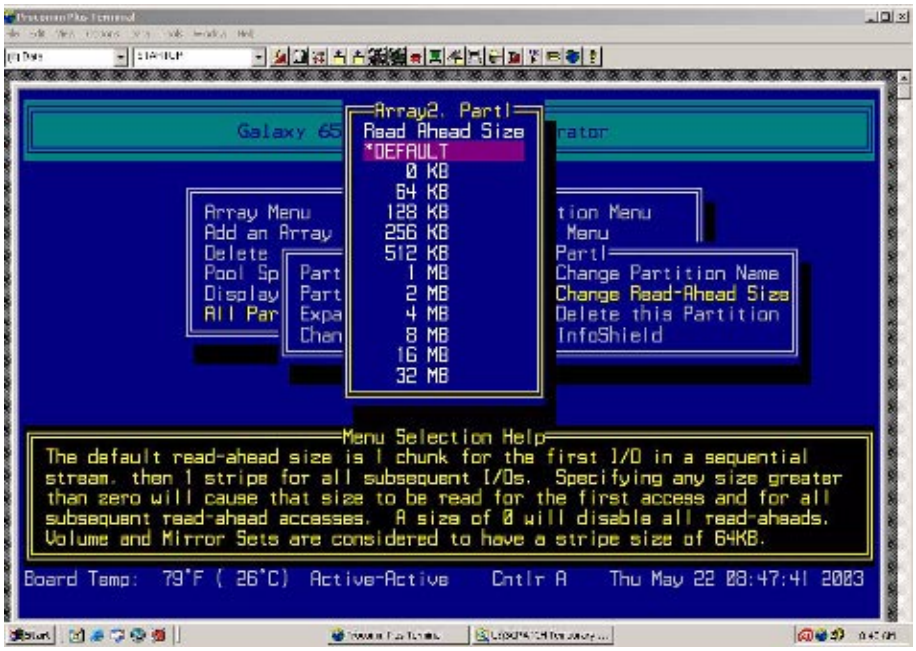
To change the read-ahead size:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. **2** Select the array you want and press **Enter**. The array menu displays. **3** Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. **4** Select the partition you want and press **Enter**. The partition menu displays.	**1** From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. **2** Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Change Cache Params** and press **Enter**.
Change Cache Params screen displays.

3 Select **Read-Ahead Size** and press **Enter**
The Read-Ahead Size screen displays.


Array2, Part1
Read Ahead Size
*DEFAULT
0 KB
64 KB
128 KB
256 KB
512 KB
1 MB
2 MB
4 MB
8 MB
16 MB
32 MB
Array Menu
Add an Array
Delete
Pool Sp
Display
All Par
Part
Part
Expa
Chan
tion Menu
Menu
Part1
Change Partition Name
Change Read-Ahead Size
Delete this Partition
InfoShield
Menu Selection Help
The default read-ahead size is 1 chunk for the first I/O in a sequential stream, then 1 stripe for all subsequent I/Os. Specifying any size greater than zero will cause that size to be read for the first access and for all subsequent read-ahead accesses. A size of 0 will disable all read-aheads. Volume and Mirror Sets are considered to have a stripe size of 64KB.
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:47:41 2003

4 Select the amount of data you want the Storage Manager to read ahead for this partition and press **Enter**.

C.3.7 Enabling or Disabling Write-back Cache

Important **This function is not available with the current software level (January 2003).**

You can enable or disable the write-back cache for a partition. By default, partition write- back cache is enabled. For most applications, this is the best setting.

Note This feature is intended for advanced users only. You may hinder your system's performance if used incorrectly.

If you are writing large chunks of sequential data (as would be done in video editing, telemetry acquisition, or data logging), you might want to experiment with disabling the write-back cache. You may see large performance gains if you are writing data under the following circumstances:

- Sequential writes
- Large I/Os in relation to the stripe size
- Deep queue depth

If you are doing any type of random access to this partition, leave the write-back cache enabled.

To enable or disable write-back cache:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Change Cache Params** and press **Enter**.
Change Cache Params screen displays.

3 Select **Write-back Cache** and press **Enter**
The Write-back Cache screen displays. The current option has an * next to it.

4 Select the option you want for this partition and press **Enter**.

C.3.8 Controlling Partition Access

The Galaxy 65 Subsystem's InfoShield capability lets you specify which hosts can access each partition. This gives you complete control of array access based on your specific needs.

Before you set up InfoShield, you should know the World Wide Name (WWN) for each host that you want to set up. Your SAN administrator should know the WWNs for your network. You can display a list of the last 16 WWNs that the Galaxy 65 Subsystem is aware of on the SAN, and you can give each WWN a nickname of your own. This makes working with the InfoShield feature faster and easier.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 16 specific hosts or all hosts for each partition LUN.

Figure 3–5 shows an example of how you can use InfoShield.

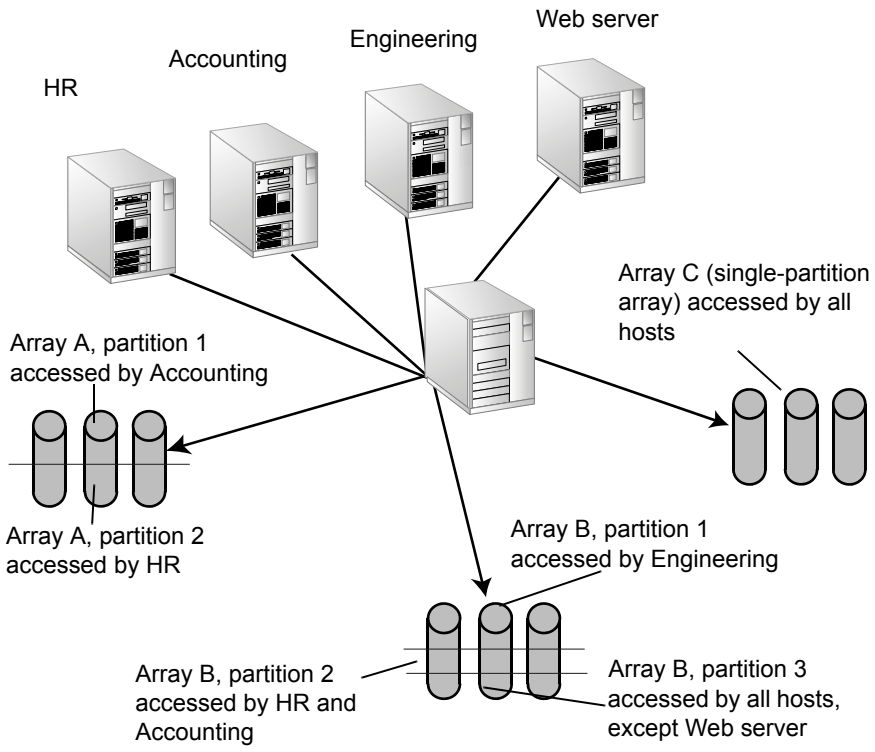

HR
Accounting
Engineering
Web server
Array C (single-partition array) accessed by all hosts
Array A, partition 1 accessed by Accounting
Array A, partition 2 accessed by HR
Array B, partition 1 accessed by Engineering
Array B, partition 2 accessed by HR and Accounting
Array B, partition 3 accessed by all hosts, except Web server

Figure 3–5 InfoShield example

For example, in Figure 3–5, Array A has two partitions. Partition 1 has an include list that contains only Accounting, so only the Accounting server can access partition 1. Array B, partition 3 has an exclude list that contains only the Web server, so all hosts *except* the Web server can access the partition. Array C uses the default setting, Include All Hosts, which permits all hosts to access the array.

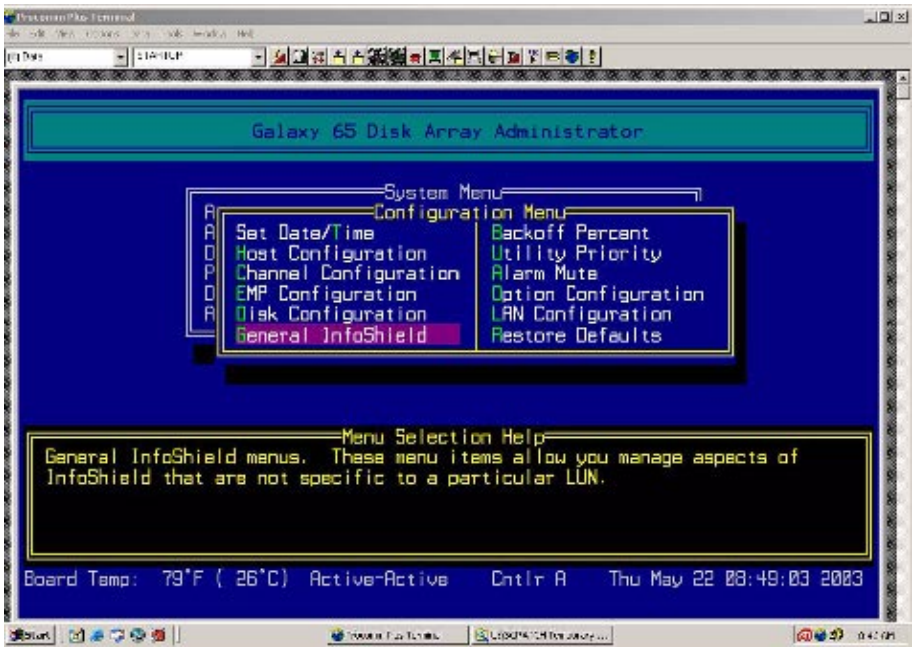
C.3.8.1 Viewing Known WWNs

You can view a list of 16 host WWNs that the Galaxy 65 Subsystem is aware of on your SAN. The Galaxy 65 Subsystem will be aware of any host that was started since the Galaxy 65 Subsystem was last restarted. Typically, hosts scan for devices during their start process. When this happens, the Galaxy 65 Subsystem saves the WWN information for the host and retains the information even after you restart the Galaxy 65 Subsystem. The list includes the last 16 hosts that started or that you named.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, and then viewing the WWN list. The host that scanned for devices most recently is first on the list. You can then give the hosts nicknames you recognize, for example you can use the computer name that has already been assigned to each host, to make InfoShield easier to manage.

To view known WWNs:

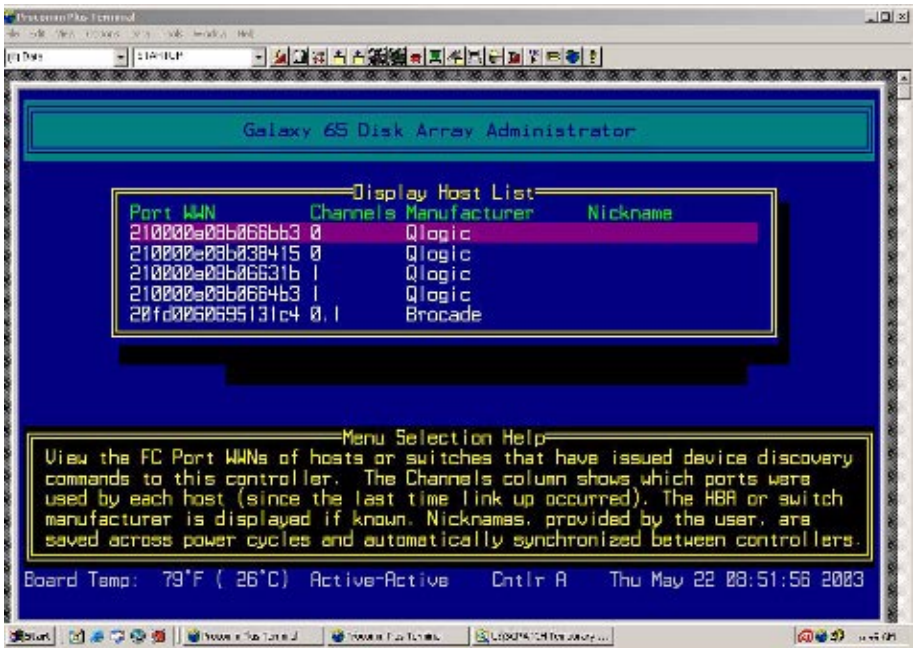
1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays



Select **General InfoShield** and press **Enter**.
The General InfoShield screen displays.

2 Select **Display Host List** and press **Enter**.

The Display Host List screen displays showing the last 16 WWNs known to the Galaxy 65 Subsystem. The WWNs are listed according to when they scanned for devices. The host that scanned for devices most recently is listed first.


Galaxy 65 Disk Array Administrator
Display Host List
Port WWN Channels Manufacturer Nickname
210000e08b066bb3 0 Qlogic
210000e08b038415 0 Qlogic
210000e08b06631b 1 Qlogic
210000e08b0664b3 1 Qlogic
20fd00505951c4 0,1 Brocade
Menu Selection Help
View the FC Port WWNs of hosts or switches that have issued device discovery commands to this controller. The Channels column shows which ports were used by each host (since the last time link up occurred). The HBA or switch manufacturer is displayed if known. Nicknames, provided by the user, are saved across power cycles and automatically synchronized between controllers.
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:51:56 2003

Note A host's WWN is placed at the top of the known hosts list whenever the host performs a device discovery or bus scanning type of operation.

3 Press **Esc** to return to the previous menu.

C.3.8.2 Creating Nicknames for Host WWNs

You can give the hosts on your SAN nicknames that you can easily recognize to make InfoShield easier to manage. For example, you can use the computer name that has already been assigned to each host.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, and then viewing the WWN list. The host that scanned for devices most recently is first on the list.

You can name up to 63 hosts, but you can only view the last 16 hosts that started or that you named. The list of 16 changes as you name hosts or as hosts restart. The nicknames are stored on the SMs, so if you change SMs, you have to rename the hosts.

To create or change nicknames for WWNs:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

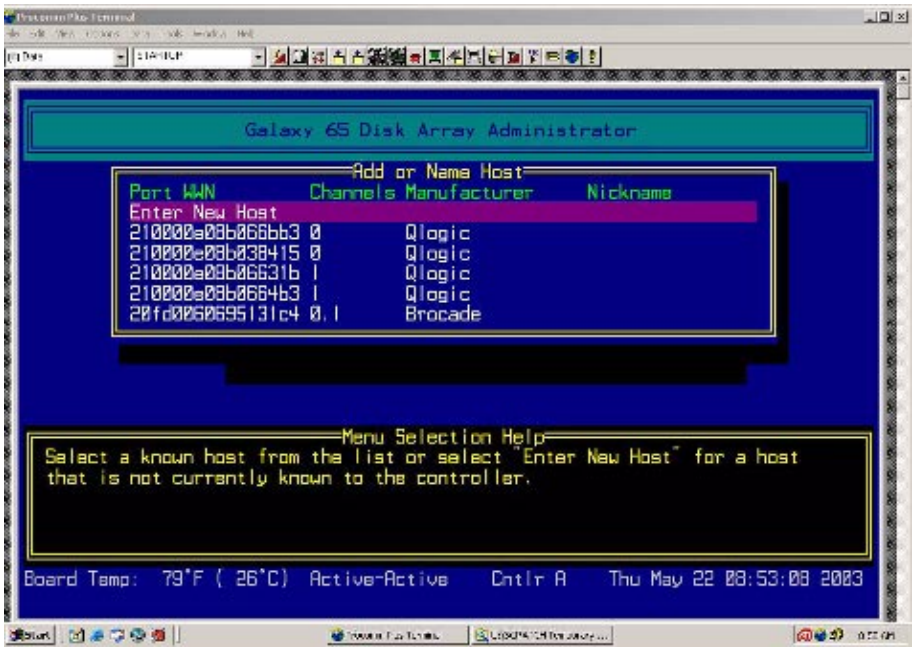
2 Select **General InfoShield** and press **Enter**.
The General InfoShield screen displays.

3 Select **Add or Name Host** and press **Enter**.

The Add or Name Host screen displays the last 16 known WWNs and host nicknames that you have set up. If you want to change the nickname, enter the new nickname in step 5. For more information, see C.3.8.1, "Viewing Known WWNs", on page 145.

If the SM is not aware of any WWNs, the list is empty and the system asks you to enter a host WWN.

Select **Enter New Host** to enter a nickname for a new host


Galaxy 65 Disk Array Administrator
Add or Name Host
Port WWN Channels Manufacturer Nickname
Enter New Host
210000e08b066bb3 0 Qlogic
210000e08b038415 0 Qlogic
210000e08b06631b 1 Qlogic
210000e08b0664b3 1 Qlogic
20fd00606951 3 1c4 0,1 Brocade
Menu Selection Help
Select a known host from the list or select "Enter New Host" for a host that is not currently known to the controller.
Board Temp: 79°F (26°C) Active-Active Cntlr A Thu May 22 08:53:08 2003

4 Select the WWN you want to name and press **Enter**.
The Enter Host Name screen displays.

5 Enter the nickname you want and press **Enter**.
You can enter up to 16 characters. You can use any combination of characters and spaces.

C.3.8.3 Configuring InfoShield

.Once you set up host nicknames, you can easily set up your InfoShield. This is where you determine which hosts can access each partition LUN.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 16 specific hosts or all hosts for each partition LUN.

The InfoShield information is stored as part of the array's metadata using the WWN for each host. If you install a new SM, the array partition's InfoShield will remain. The InfoShield will also remain if you change the partition's LUN.

Note Changes to InfoShield take effect immediately, therefore, you should make changes that limit access to partitions when the partitions are not in use.

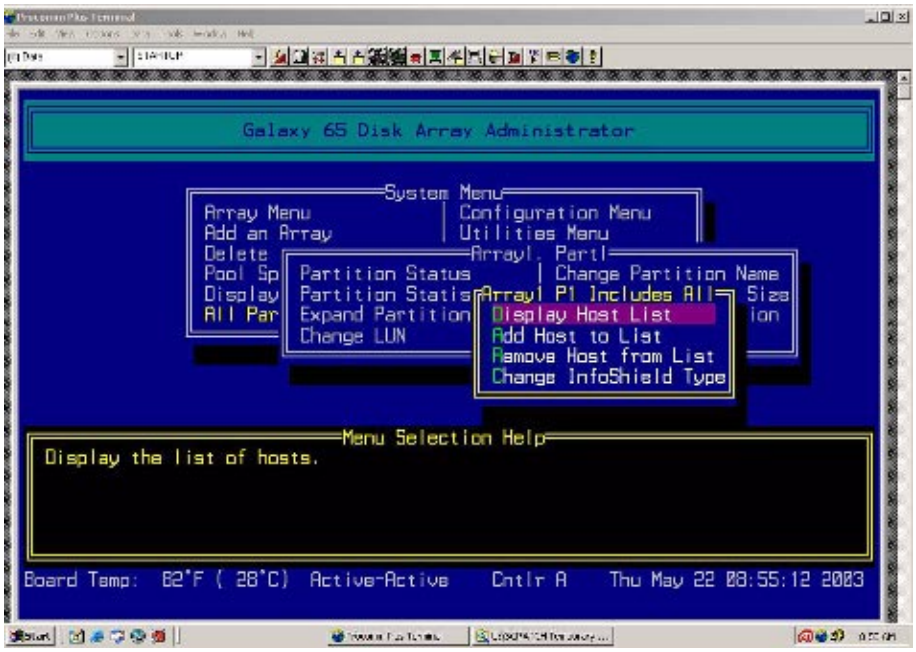
To set up InfoShield:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **InfoShield** and press **Enter**.

The InfoShield menu displays and shows the current InfoShield type at the top. The default setting for each partition LUN is Include All Hosts. This results in all hosts being able to access all partitions. You can change the list type using the Change InfoShield Type option. See the next step.



3 Select the option you want and press **Enter**.

- **Display Host List:** Displays a list of the hosts currently on the include or exclude list for the selected partition. This option only displays hosts if you have already used Add Host to List and added one or more WWNs to an include or exclude list.

- **Add Host to List**: Displays the Enter Host WWN screen where you enter the WWN or name (alias) or select the host you want to add to the current list for the selected partition. The list of WWNs and nicknames that displays contains only the last 16 hosts that started or that you named. If you know other WWNs or names, you can enter the WWN or nickname. Enter the WWN or nickname or select the host from the list and press **Enter**.

- **Remove Host from List**: Displays the Remove Host from List screen, which contains a list of the hosts currently on the include or exclude list for the selected partition. Select the WWN of the host you want to remove from the list and press **Enter**.

- **Change InfoShield Type**: Displays the Change InfoShield Type screen where you can change the InfoShield type to one of four options described below. Changing the InfoShield type does not add or remove any hosts in previously created lists.

  – **Include All Hosts**: Permits all hosts on the network to access the selected array. This is the default InfoShield type. This results in all hosts being able to access all partitions. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.

  – **Include Listed Hosts**: Lets you enter or select the WWNs of the specific hosts you want to be able to access the selected partition. The list of WWNs and nicknames that displays contains only the last 16 hosts that started or that you named. If you know other WWNs or names, you can enter the WWN or nickname.

  – **Exclude All Hosts**: Permits *no* hosts on the network to access the selected partition. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.

  – **Exclude Listed Hosts**: Lets you enter or select the WWNs or names (aliases) of the specific hosts you do *not* want to be able to access the selected partition. The list of WWNs and nicknames that displays contains only the last 16 hosts that started or that you named. If you know other WWNs or nicknames, you can enter the WWN or nickname.

  Whether you use an include or exclude list depends on your needs. You may want to determine which list would be shorter and create the shorter list.

If you have changed the InfoShield, the system confirms that you want to make the change.

4 Select **Yes** and press **Enter** to make the changes.
The system confirms that the changes are made.

5 Press **Esc** to return to the InfoShield screen.

C.3.8.4 Changing All Partitions to Include All Hosts

You can change all partitions to include all hosts from the General InfoShield menu. This lets you quickly change the InfoShield setting for all partitions at once to permit all hosts to see all partitions, overriding

the existing setting for each partition. However, the Galaxy 65 Subsystem retains all existing include and exclude lists.

If you use this option and later need to change back to your previous InfoShield settings, you must do so by changing the setting for each partition individually. See C.3.8.3, "Configuring InfoShield", on page 148.

To change all partitions to include all hosts:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **General InfoShield** and press **Enter**.
The General InfoShield screen displays.

3 Select **Include All Hosts** and press **Enter**.
The system confirms that the changes are made.

4 Press **Esc** to return to the General InfoShield screen.

C.3.9 Deleting a Partition

You can delete a partition when you no longer need it and you want to use the space for another purpose.

Caution *Deleting a partition deletes all data contained in the partition.*

Note You cannot delete a partition while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the partition.

To delete a partition:

1 Display the partition menu.

From the Array Menu	From the All Partitions Menu
1 From the System Menu, select **Array Menu** and press **Enter**. The Select Array screen displays with a list of existing arrays. 2 Select the array you want and press **Enter**. The array menu displays. 3 Select **Partition Menu** and press **Enter**. The Select Partition screen displays with a list of existing partitions for the current array. 4 Select the partition you want and press **Enter**. The partition menu displays.	1 From the System Menu, select **All Partitions Menu** and press **Enter**. The Select Partition or Free Area screen displays with a list of existing partitions and free space. 2 Select the partition you want and press **Enter**. The partition menu displays.

2 Select **Delete This Partition** and press **Enter**.
The system asks you to confirm the deletion.

3 Select **Yes** and press **Enter**.
The Delete Partition option is also available from the Array Menu.

Appendix D

Monitoring System Status

D.1 Introduction

Using the Disk Array Administrator, you can monitor your system. You should monitor your system regularly to ensure that the Galaxy 65 Subsystem, disks, and arrays are working properly. The Galaxy 65 Subsystem and Disk Array Administrator software let you monitor the status several ways:

- Galaxy 65 Subsystem LEDs (refer to Figure 4–1)
- Event log (see page 154)
- Module status screens (see page 158)
- Hardware and configuration information screens (see page 159)
- Complete event, hardware, and configuration capture (see page 164)
- Drive error statistics (see page 164)
- Overall Statistics screen (see page 165)
- Array status screen (see page 117)
- Disk status screen (see page 119)

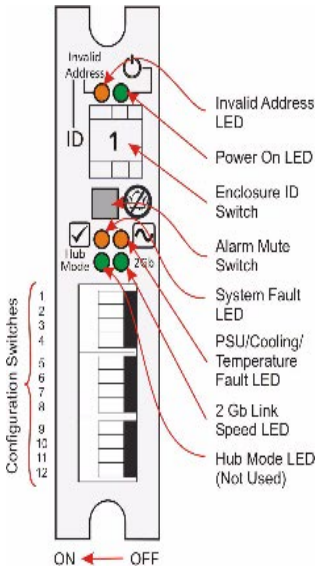


Figure 4–1 Operators Panel

D.2 Displaying the Event Log

The SM's event log contains important information about the status of the Galaxy 65, disks, and arrays. You should check it regularly for each SM to monitor the status of your system.

Below is a list of some of the key warning and failure events included in the event log during operation:

- Disk detected error
- Disk channel error
- Battery failure
- Drive down
- Power up
- Array critical
- Array offline
- Temperature warning
- Temperature failure (this leads to a shutdown which is also logged)
- Voltage warning
- Voltage failure (this leads to a shutdown which is also logged)

The event log stores the most recent 400 events. Events have a time stamp next to them with one-second granularity.

Note If you are having a problem with the Galaxy 65 Subsystem or an array, check the event log before calling technical support. Event messages may let you resolve the problem without calling.

You can view the event information three ways:

- Most recent event
- One event at a time, most recent event first
- Full screen of events at a time

You can also capture the event log to a file. See D.2.4, "Capturing the Event Log", on page 157.

D.2.1 Viewing the Most Recent Event

When you first access the Disk Array Administrator software, any events that have occurred display. Informational events scroll by automatically. Warning events (yellow text on a black background) and error events (white text on a red background) display until you press **Enter** or **Esc**. Once all the events

display, the initial screen displays. The initial screen alternates between displaying the date, time, and temperature and the model number of your hardware.

You can bypass all events by pressing **Tab**.

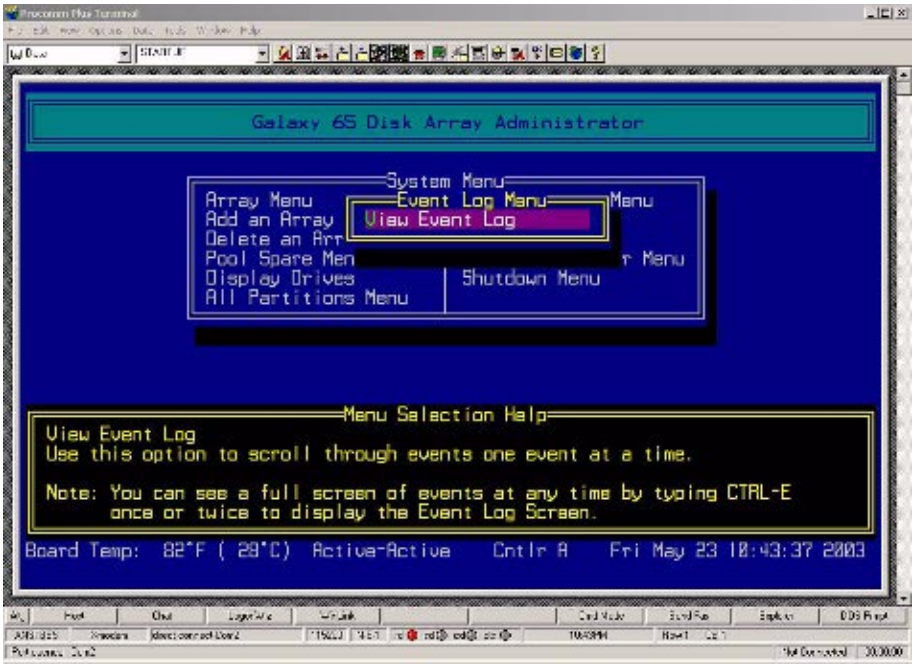
D.2.2 Viewing One Event at a Time

You can view an SM's events one at a time. The events display in reverse chronological order, that is, the most recent event is first.

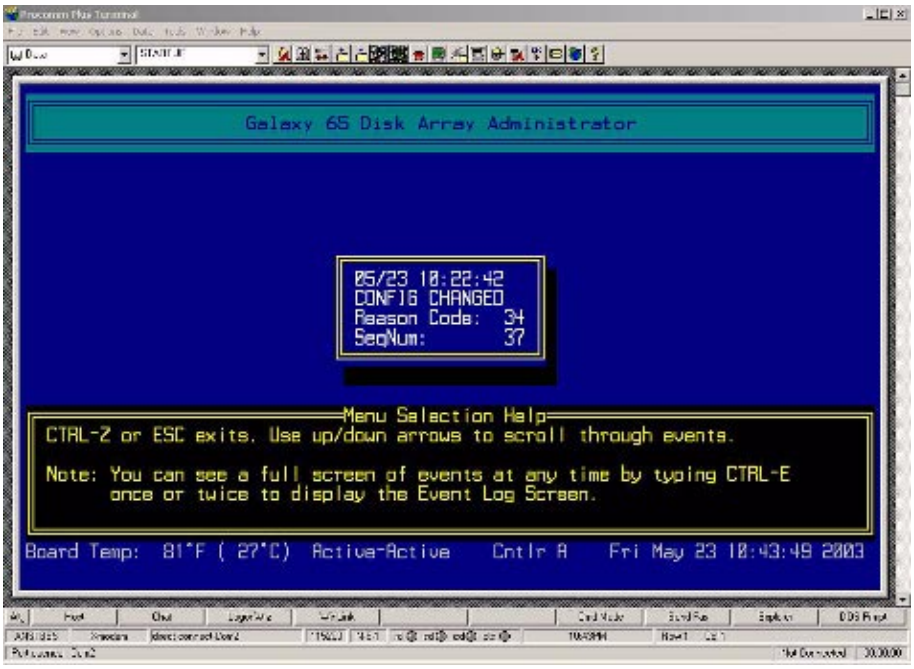
If an event displays several parameters, you can see all of them when you view the log one event at a time. When you view a whole screen of events, some parameters may be truncated.

To view one event at a time:

1 From the System Menu, select **Event Log Menu** and press **Enter**
The Event Log Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Arr
Pool Spare Men
Display Drives
All Partitions Menu
Event Log Menu
View Event Log
Menu
r Menu
Shutdown Menu
Menu Selection Help
View Event Log
Use this option to scroll through events one event at a time.
Note: You can see a full screen of events at any time by typing CTRL-E
once or twice to display the Event Log Screen.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 10:43:37 2003

2 Select **View Event Log** and press **Enter**
The event log screen displays the last event that occurred.


Galaxy 65 Disk Array Administrator
05/23 10:22:42
CONFIG CHANGED
Reason Code: 34
SeqNum: 37
Menu Selection Help
CTRL-Z or ESC exits. Use up/down arrows to scroll through events.
Note: You can see a full screen of events at any time by typing CTRL-E
once or twice to display the Event Log Screen.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:43:49 2003

3 Press ↑ to see the previous event.
You can continue to view earlier events by pressing ↑.

4 Press **Esc** to return to the Event Log Menu.

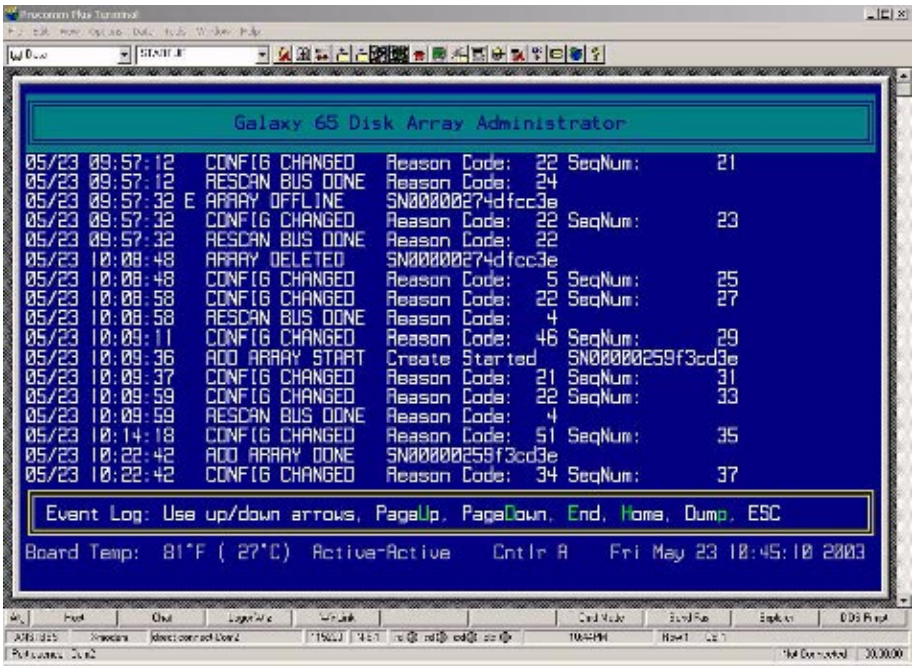
D.2.3 Viewing a Whole Screen of Events

You can also view a SM's events from the log file a whole screen at a time. This lets you quickly review all recent events. The events display in chronological order, that is, the most recent event is last.

When you view a whole screen of events, some parameters may be truncated. If an event displays several parameters, you can see all of them when you view the log one event at a time.

To view a whole screen of events:

1 From anywhere in the Disk Array Administrator software, press **CTRL-E** until the Event Log screen displays.
The first screen of events from the event log displays


Galaxy 65 Disk Array Administrator
05/23 09:57:12 CONFIG CHANGED Reason Code: 22 SeqNum: 21
05/23 09:57:12 RESCAN BUS DONE Reason Code: 24
05/23 09:57:32 E ARRAY OFFLINE SN00000274dfcc3e
05/23 09:57:32 CONFIG CHANGED Reason Code: 22 SeqNum: 23
05/23 09:57:32 RESCAN BUS DONE Reason Code: 22
05/23 10:08:48 ARRAY DELETED SN00000274dfcc3e
05/23 10:08:48 CONFIG CHANGED Reason Code: 5 SeqNum: 25
05/23 10:08:58 CONFIG CHANGED Reason Code: 22 SeqNum: 27
05/23 10:08:58 RESCAN BUS DONE Reason Code: 4
05/23 10:09:11 CONFIG CHANGED Reason Code: 46 SeqNum: 29
05/23 10:09:36 ADD ARRAY START Create Started SN00000259f3cd3e
05/23 10:09:37 CONFIG CHANGED Reason Code: 21 SeqNum: 31
05/23 10:09:59 CONFIG CHANGED Reason Code: 22 SeqNum: 33
05/23 10:09:59 RESCAN BUS DONE Reason Code: 4
05/23 10:14:18 CONFIG CHANGED Reason Code: 51 SeqNum: 35
05/23 10:22:42 ADD ARRAY DONE SN00000259f3cd3e
05/23 10:22:42 CONFIG CHANGED Reason Code: 34 SeqNum: 37
Event Log: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:45:10 2003

2 Press **U** to page up or **D** to page down in the log or use the other keys as listed at the bottom of the screen to navigate within the event log.

3 Keep pressing **CTRL-E** to page through the other information screens and return to the menu.

D.2.4 Capturing the Event Log

You can also capture a SM's entire event log, which saves it to a file on your hard drive. This is useful if you want to print the log or attach it to an e-mail message.

The steps below use HyperTerminal as the terminal emulator software. If you use a different terminal emulator, your procedure may be different.

To capture the event log file:

1 With HyperTerminal up and running as your RS-232 interface terminal, press **CTRL-E** until the event log displays.

2 From the Transfer menu in HyperTerminal, select Capture Text.
The Capture Text window displays.

3 Enter the path and file name you want to use to store the log file contents.
Save the file with a.txt file extension.

4 Click **Start**.

5 Press **P** on the keyboard to begin the transfer.

6 From the Transfer menu in HyperTerminal, select Capture Text, then select Stop.

7 To capture the event log for the other SM, repeat steps 1 through 6 from the computer connected to the other SM.

D.3 Displaying Module Status Information

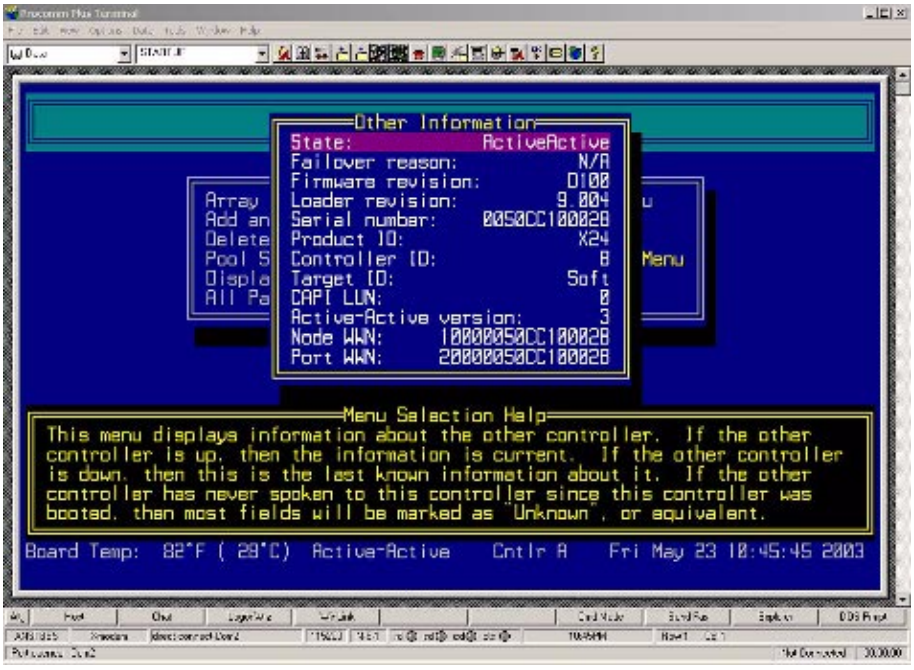
You can display status information about each of the modules in your Galaxy 65 Subsystem.

- LRC I/O modules
- Power Supply/Cooling modules (two)

To display module status information:

1 From the System Menu, select **Other Controller Menu** and press **Enter**.
The Other controller Menu screen displays.

2 Select the operation you want to perform


Other Information
State: ActiveActive
Failover reason: N/A
Firmware revision: 0100
Loader revision: 9.004
Serial number: 0050CC100028
Product ID: X24
Controller ID: B
Target ID: Soft
CAPI LUN: 0
Active-Active version: 3
Node WWN: 10000050CC100028
Port WWN: 20000050CC100028
Menu Selection Help
This menu displays information about the other controller. If the other controller is up, then the information is current. If the other controller is down, then this is the last known information about it. If the other controller has never spoken to this controller since this controller was booted, then most fields will be marked as "Unknown", or equivalent.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 10:45:45 2003

3 Press **Esc** to return to the manage module menu.

D.4 Displaying Hardware and Configuration Information

You can display the Galaxy 65 Subsystem's hardware and configuration information. This is where you can see what version of the firmware you have. Technical support personnel may request this information.

You can display the hardware and configuration information two ways:

- Hardware information only
- Hardware and configuration information

Table 4–1 lists the configuration information that is available.

Table 4–1 Configuration information (per SM)

Group	Field	What displays	Field	What displays
HOST 0 HOST 1	Active Channel	Speed—1 Gb/s or 2 Gb/s as set in the Disk Array Administrator software.		
	Topology	Loop or Point-to-Point as set in the Disk Array Administrator software.		
	Node WWN	FC World Wide Name for node.		
	Port WWN	FC World Wide Name for port.		
	Loop ID	SOFT or a specific number as set in the Disk Array Administrator software.	Current Loop ID	Currently assigned value or Inactive if the FC link is not active.
	FC Addr	24-bit FC address or None if the FC link is not active.	AL_PA	Currently assigned value or None if the FC link is not active.
	CAPI LUN	NONE or specific number as set in the Disk Array Administrator software.		

Table 4–1 Configuration information (Continued)(per SM)

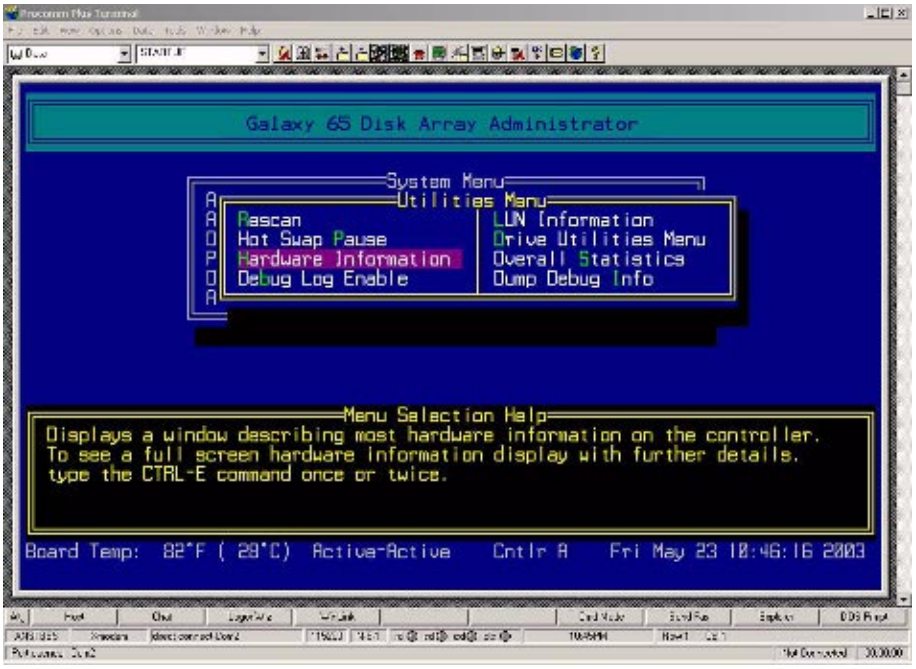
Group	Field	What displays	Field	What displays
DISK 0 DISK 1 DISK 2 DISK 3	Online or Offline Health	Status of disk channel based on whether a disk enclosure is connected and can be: Good, Down (not online) Probation (had errors but now has a time limit before it gets back to good status or failure for some reason), Degraded (had some errors but link has not failed), Failed (excessive errors causing link to fail), Unknown (status cannot be determined).	Speed	1 or 2 Gbit/sec as set in Disk Array Administrator software.
	Loop map	Lists disk drive loop IDs in the order discovered on the loop.		
DATAMGR	Operating Mode	Always Active-Active.		
	A-A Status	Current status of the Galaxy 65 (Not Failed Over or Failed Over).		
	A-A Version	Version of the active-active software.		
	Backoff	Percentage set in Disk Array Administrator software (1% is the default and recommended value).	Utility Pri	HIGH, MED, or LOW utility priority as set in Disk Array Administrator software.
	Alarm Mute	ON or OFF as set in Disk Array Administrator software.	Battery	ENABLED or DISABLED as set in Disk Array Administrator software.
	Cache Lock	ON or OFF as set in Disk Array Administrator software.	Dyn. Spare	ON or OFF as set in Disk Array Administrator software.
DISK	WBCache	ENABLED, DISABLED, or NO MODIFY as set in Disk Array Administrator software.	SMART	ENABLED, DISABLED, or NO MODIFY as set in Disk Array Administrator software.

Table 4–1 Configuration information (Continued)(per SM)

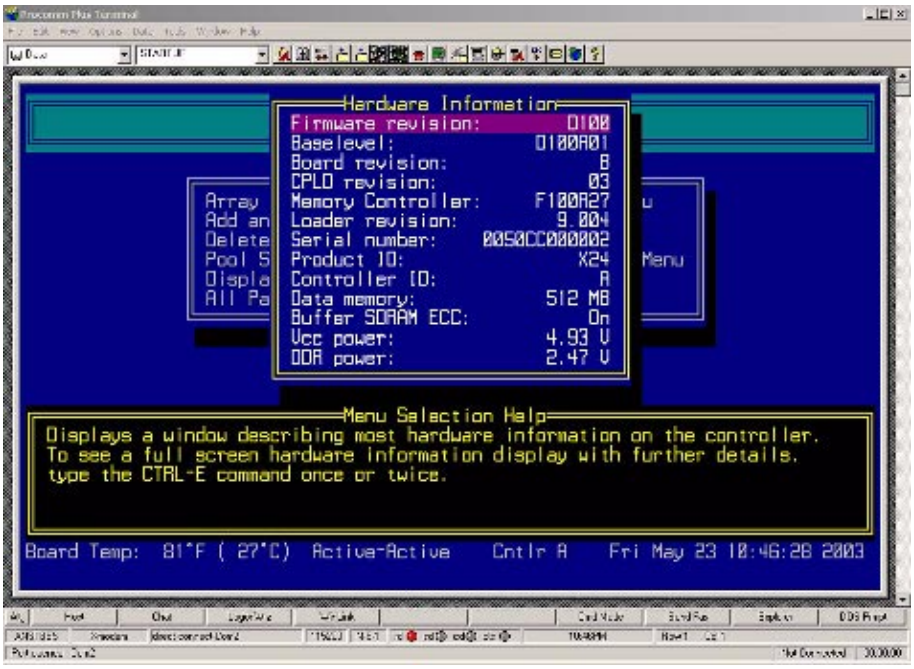
Group	Field	What displays	Field	What displays
CAPI	Version	Version of the Configuration Application Programming Interface.		
FC LIB	Version	Version of the FC software.		
EMP	Poll Rate	Number of seconds as set in the Disk Array Administrator software.	Temperature	ON or OFF as set in Disk Array Administrator software.
	Slot flags	ON or OFF as set in Disk Array Administrator software.	Global Flags	ON or OFF as set in Disk Array Administrator software.

To display hardware information only:

1 From the System Menu, select **Utilities Menu** and press **Enter**.
The Utilities Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Utilities Menu
Rescan
Hot Swap Pause
Hardware Information
Debug Log Enable
LUN Information
Drive Utilities Menu
Overall Statistics
Dump Debug Info
Menu Selection Help
Displays a window describing most hardware information on the controller.
To see a full screen hardware information display with further details.
type the CTRL-E command once or twice.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 10:46:16 2003

2 Select **Hardware Information** and press **Enter**.
The Hardware Information screen displays

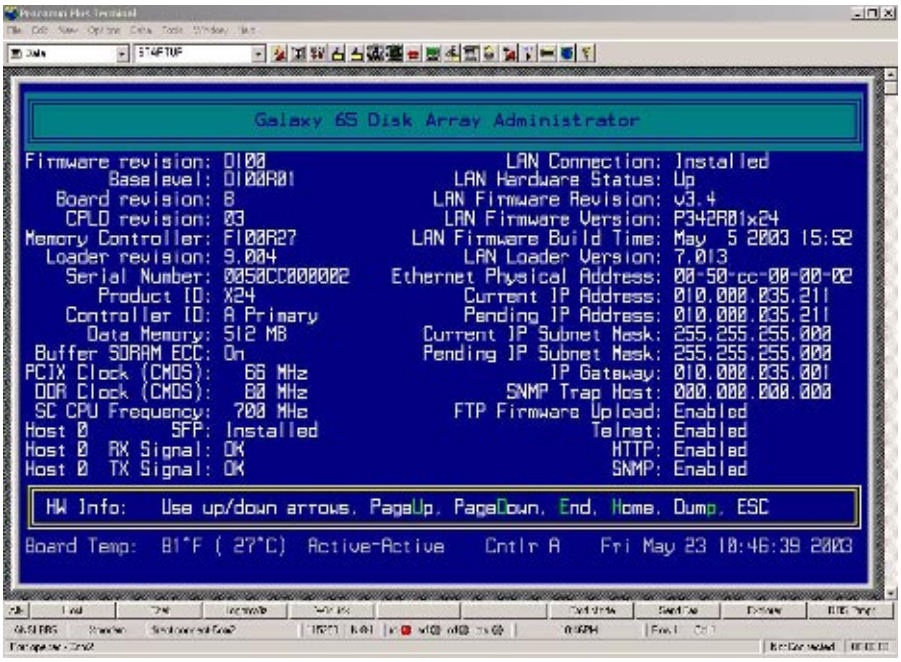

Hardware Information
Firmware revision: 0100
Baselevel: 0100A01
Board revision: B
CPLD revision: 03
Memory Controller: F100A27
Loader revision: 9.004
Serial number: 0050CC000002
Product ID: X24
Controller ID: A
Data memory: 512 MB
Buffer SDRAM ECC: On
Vcc power: 4.93 V
DDR power: 2.47 V
Menu Selection Help
Displays a window describing most hardware information on the controller.
To see a full screen hardware information display with further details,
type the CTRL-E command once or twice.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:46:26 2003

3 Press **Esc** to return to the Utilities Menu.

To display hardware and configuration information:

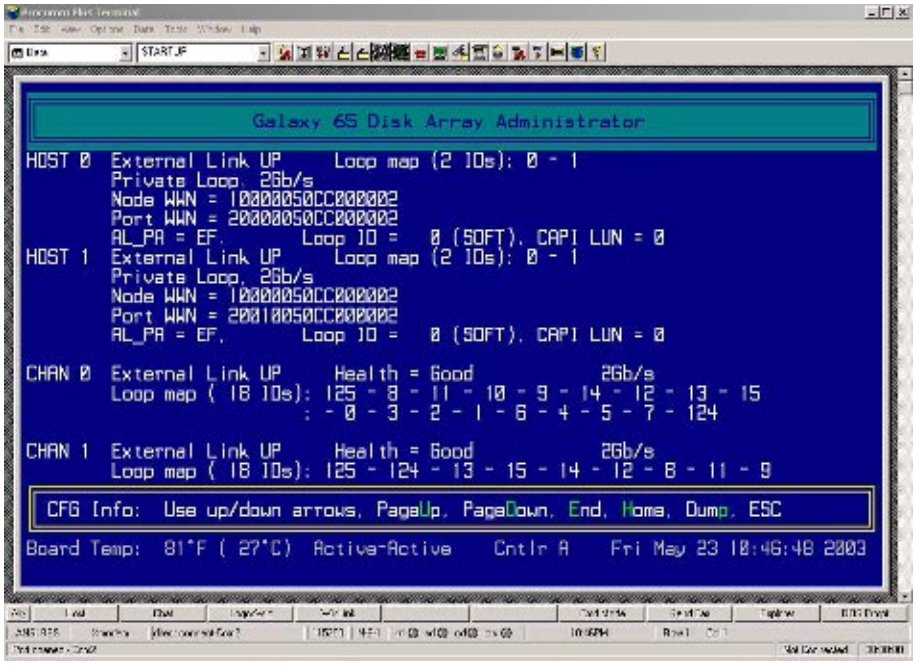
1 From anywhere in the Disk Array Administrator software, press **CTRL-E** until the HW Info screen displays.

The HW Info screen displays. Press **U** to page up or **D** to page down in the screen or use the other keys as listed at the bottom of the screen to navigate within the HW Info screen.


Galaxy 6S Disk Array Administrator
Firmware revision: 0100
Baselevel: 0100R01
Board revision: 8
CPLD revision: 03
Memory Controller: F100R27
Loader revision: 9.004
Serial Number: 0050CC000002
Product ID: X24
Controller ID: A Primary
Data Memory: 512 MB
Buffer SDRAM ECC: On
PCIX Clock (CMOS): 66 MHz
DDR Clock (CMOS): 80 MHz
SC CPU Frequency: 700 MHz
Host 0 SFP: Installed
Host 0 RX Signal: OK
Host 0 TX Signal: OK
LAN Connection: Installed
LAN Hardware Status: Up
LAN Firmware Revision: v3.4
LAN Firmware Version: P342R01x24
LAN Firmware Build Time: May 5 2003 15:52
LAN Loader Version: 7.013
Ethernet Physical Address: 00-50-cc-00-00-02
Current IP Address: 010.000.035.211
Pending IP Address: 010.000.035.211
Current IP Subnet Mask: 255.255.255.000
Pending IP Subnet Mask: 255.255.255.000
IP Gateway: 010.000.035.001
SNMP Trap Host: 000.000.000.000
FTP Firmware Upload: Enabled
Telnet: Enabled
HTTP: Enabled
SNMP: Enabled
HW Info: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:46:39 2003

2 Press **CTRL-E** again.

The CFG Info screen displays. Press **U** to page up or **D** to page down in the screen or use the other keys as listed at the bottom of the screen to navigate within the CFG screen.


Galaxy 6S Disk Array Administrator
HOST 0 External Link UP Loop map (2 IDs): 0 - 1
Private Loop, 2Gb/s
Node WWN = 10000050CC000002
Port WWN = 20000050CC000002
AL_PA = EF, Loop ID = 0 (SOFT), CAPI LUN = 0
HOST 1 External Link UP Loop map (2 IDs): 0 - 1
Private Loop, 2Gb/s
Node WWN = 10000050CC000002
Port WWN = 20010050CC000002
AL_PA = EF, Loop ID = 0 (SOFT), CAPI LUN = 0
CHAN 0 External Link UP Health = Good 2Gb/s
Loop map (18 IDs): 125 - 8 - 11 - 10 - 9 - 14 - 12 - 13 - 15
: - 0 - 3 - 2 - 1 - 6 - 4 - 5 - 7 - 124
CHAN 1 External Link UP Health = Good 2Gb/s
Loop map (18 IDs): 125 - 124 - 13 - 15 - 14 - 12 - 8 - 11 - 9
CFG Info: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:46:48 2003

3 Press **CTRL-E** to display the next screen of configuration information or **Esc** to return to where you started from.

D.5 Capturing the Event Log, Hardware, and Configuration Information

You can capture and save the following information to a file on your hard drive:

- Entire event log
- All hardware information
- All configuration information
- All debug information that is turned on.

This is useful if you want to print all of this information or attach it to an e-mail message.

The steps below use HyperTerminal as the terminal emulator software. If you use a different terminal emulator, your procedure may be different.

To capture the event log, hardware, and configuration information:

1. With HyperTerminal up and running as your RS-232 interface terminal, from the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.
2. From the **Transfer** menu in HyperTerminal, select **Capture Text**.
   The Capture Text window displays.
3. Enter the path and file name you want to use to store the log file contents.
   Save the file with a.txt file extension.
4. Click **Start**.
5. Select **Dump Debug Info** and press **Enter**.
6. From the **Transfer** menu in HyperTerminal, select **Capture Text**, then select **Stop**.
7. To capture the same information for the other SM, repeat steps1 through 6 from the computer connected to the other SM.

D.6 Displaying Drive Errors and Resetting Error Statistics

You can display drive errors for a specific drive. You know a drive has errors when you see the letter E in the first column of the Display Drives screen.

To display drive errors:

1 From the System Menu, select **Display Drives** and press **Enter**.
The Display Drives screen displays.

2 If a drive has an E next to it, select the drive and press **Enter** to display the error information.

Some errors are primarily for information purposes to help you diagnose drive and enclosure problems. For more information about SMART errors, refer to the drive manufacturer's specifications. For more information about FC errors, refer to: www.t11.org, click **Drafts**, find the *FC-FS 1.6 T11/02-018v0 dpANS - Fibre Channel Framing and Signaling Interface* document, and go to section 21.

To reset the error statistics, select **Reset drive error statistics** and press **Enter**.

3 Press **Esc** to return to the list of drives.

D.7 Displaying Overall Statistics

You can display two types of aggregate statistics for all partition LUNs:

- General statistics (Similar statistics are also available for individual partition LUNs. For more information, see C.3.2.2, "Viewing Partition Statistics", on page 136.)
  - I/O operations per second (IOPS)
  - Bandwidth (in millions of bytes per second)
  - Number of read operations
  - Number of write operations
  - Total sectors (512 bytes) read
  - Total sectors written
  - Total current command queue depth across all LUNs

- Host read/write histogram that shows how many host reads and writes fell into a particular size range. The I/O ranges are based on powers of two:
  - 1 Sector
  - 2–3 Sectors
  - 4–7 Sectors
  - 8–15 Sectors
  - 16–31 Sectors
  - 32–63 Sectors
  - 64–127 Sectors
  - 128–255 Sectors
  - 256–511 Sectors
  - 512–1023 Sectors
  - 1024–2047 Sectors
  - 2048 (and larger) Sectors

Tip: This information may be helpful in interpreting performance based on individual system configuration such as HBA, driver configuration, SAN configuration, and host operating system configuration. The statistical information can be useful to profile applications and their usage of a partition, which could be used to determine if additional arrays would increase performance and what type of RAID level is applicable to your needs. You may want to analyze the performance of the same application using

different RAID levels to determine which level gives you the best performance. See , ”Array Basics”, on page 89 for more details on RAID levels

Note The statistics are provided as general information for your use, however, they are not intended for benchmarking purposes.

To access the overall array statistics:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.
2. Select **Overall Statistics** and press **Enter**
   The Overall Statistics screen displays.
3. Select **View Statistics** and press **Enter |**
   The View Statistics screen displays.
4. Press **Esc** to return to the Overall Statistics screen.

To access the read/write histogram:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.
2. Select **Overall Statistics** and press **Enter**
   The Overall Statistics screen displays.
3. Select **View R/W Histogram** and press **Enter**.
   The View R/W Histogram screen displays.
4. Press **Esc** to return to the Overall Statistics screen.

D.7.1 Resetting Overall Statistics

You can also reset all of the overall statistics back to zero. You may want to reset the statistics if you are monitoring performance or doing benchmark testing.

Note Resetting statistics here also resets the statistics for each individual partition. See C.3.2.3, ”Resetting Partition Statistics”, on page 138.

To reset overall statistics:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.
2. Select **Overall Statistics** and press **Enter**
   The Overall Statistics screen displays.
3. Select **Reset All Statistics** and press **Enter**.
   The system confirms that you want to make the change.
4. Select **Yes** and press **Enter**.
   The system confirms that the statistics have been cleared and returns to the Overall Statistics screen.

Appendix E

Managing Spares

Using the Disk Array Administrator, you can manage spares.

Rorke Data RAID controllers automatically reconstruct redundant (fault-tolerant) arrays (RAID 3, RAID 4, RAID 5, RAID 50, and mirrored) if an array becomes critical and a properly sized spare drive is available. An array becomes critical when one or more member drives fails.

You can set up two types of spare drives:

- **Dedicated**: Available drive that is assigned to a specific array (see page -168).
- **Pool**: Available drive that is assigned to the pool, which can provide a spare for any failed drive in any redundant array. Pool spares are available to both SMs. If a drive in an array on either SM fails, the Galaxy 65 Subsystem can use a pool spare to reconstruct the array (see page -170).

In addition, if you enable the Dynamic Spares option and a drive fails, you can replace the drive and the SM will rescan the bus, find the new disk drive, and automatically start reconstruction of the array (see page 169).

The SM looks for a dedicated spare first. If it does not find a properly sized dedicated spare, it looks for a pool spare.

If a reconstruct does not start automatically, it means that no valid spares are available. To start a reconstruct, you must:

1. Replace the failed drive, if no other drive is available.
2. Add the new drive or another available drive as a dedicated spare to the array or as a pool spare.

   Remember that any pool spares added might be used by any critical array, not necessarily the array you want.

E.1 Managing Dedicated Spares

Dedicated spares are unused disk drives that you assign as a spare to a specific array. The disk must be as large as the smallest member of the array. You cannot use a dedicated spare drive as a member of an array or as a pool spare.

Although using a dedicated spare is the most secure way to provide spares for your arrays, it is also expensive to keep an idle drive assigned to each array. An alternative method is to assign one or more idle drives to the spare pool. See E.3, ”Managing the Spare Pool”, on page 170.

E.1.1 Adding a Dedicated Spare

You assign dedicated spare drives to a specific array. If a member drive in the array fails, the Galaxy 65 Subsystem uses a dedicated spare drive to automatically reconstruct the array. You can add dedicated spare drives to mirrored (RAID 1 and RAID 10) and parity (RAID 3, RAID 4, RAID 5, and RAID 50) arrays when you create the array or afterward. You can assign up to four dedicated spare drives to an array. For more information about assigning spares when you create an array, see C.1, ”Creating Arrays”, on page 105.

Note You cannot add a spare that does not have enough capacity to replace the smallest member in the array.

To add a dedicated spare:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press **Enter**.
   The array menu displays.

3. Select **Add Spare** and press **Enter** T
   The list of drives screen displays listing the available drives.

Note If a drive was a member of an array and was removed from the array, you cannot use it as a spare until you clear the drive’s metadata. For more information, see F.1.2, ”Clearing Metadata from a Drive”, on page 177.

To toggle the display between the drive model number, serial number, and the node and WWN, press **T**.

4. Select the drive you want to add as a spare and press **Enter**.
   The system confirms the change.

5. Select **Yes** and press **Enter**.

E.1.2 Deleting a Dedicated Spare

You can delete a dedicated spare drive from an array at any time.

To delete a dedicated spare:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.

2 Select the array you want and press **Enter**.
The array menu displays.

3 Select **Delete Spare** and press **Enter**.

4 Select the spare drive you want to delete and press **Enter**.
The system confirms the deletion.

5 Select **Yes** and press **Enter** to delete the spare.
The drive is now available for use in an array or as a spare.

E.2 Enabling Dynamic Spares

The Dynamic Spares option lets you use all of your disk drives in redundant arrays, without assigning one as a spare. For example, if you enable Dynamic Spares and a drive fails, you can replace the drive and the SM will rescan the bus, find the new disk drive, and automatically start reconstruction of the array. The SM automatically finds the new drive and reconstructs the array.

With Dynamic Spares enabled, if you have spares or available drives, the SM first looks for a dedicated or spare pool drive for the reconstruction. If none is found, it uses an available drive, which the SM automatically assigns as a spare and starts reconstruction.

You must make sure that the new or available drive has enough capacity to replace the smallest member in the array and does not contain metadata (see F.1.2, ”Clearing Metadata from a Drive”, on page 177).

A change to this setting on either SM is automatically updated on the other SM.

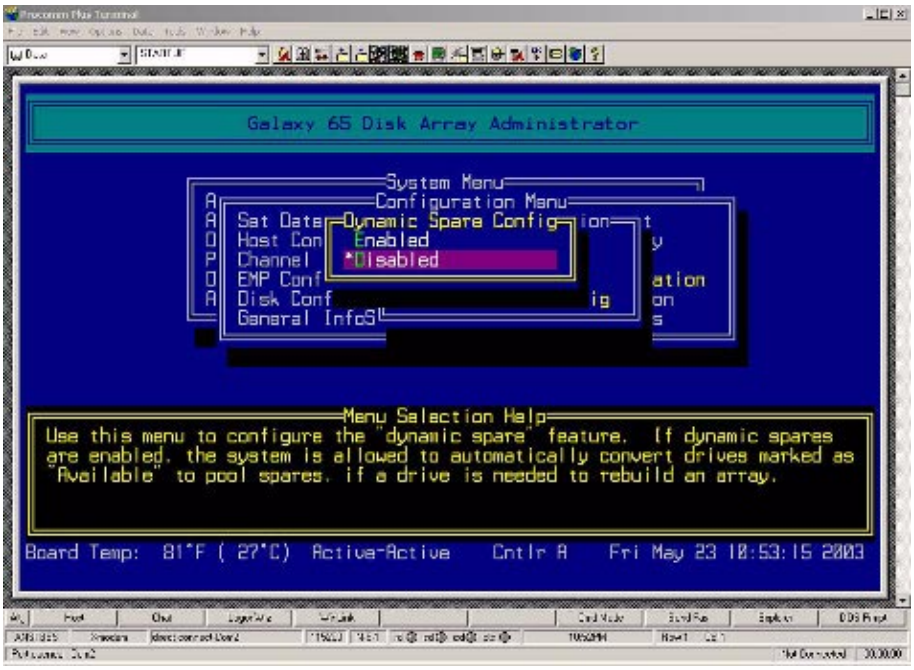
Note Performance in systems *without* an enclosure management processor (EMP) will decrease if an array becomes critical with this option enabled and there are no available drives to start reconstruction. To minimize the performance impact, increase the Galaxy 65 Subsystem rescan rate as described in the steps below.

To enable dynamic spares:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Option Configuration** and press **Enter**.
The Option Configuration screen displays.

3 Select **Dynamic Spare Configuration** and press **Enter**.
The Dynamic Spare Config screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Dynamic Spare Config
Enabled
*Disabled
Menu Selection Help
Use this menu to configure the "dynamic spare" feature. If dynamic spares are enabled, the system is allowed to automatically convert drives marked as "Available" to pool spares, if a drive is needed to rebuild an array.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:53:15 2003

4 Select **Enabled** and press **Enter**.
The Rescan Rate screen displays.

5 Enter the rescan rate in minutes.

This tells the SM how often it should look for an available drive by rescanning the bus. Rescanning the bus frequently can affect performance. If you have an EMP, the dynamic spare configuration will not rescan the bus. The EMP will detect the new drive and tell the SM to rescan; the rescan rate you set here will not affect the system.

The system confirms the change.

6 Select **Yes** and press **Enter**.

E.3 Managing the Spare Pool

The spare pool lets you have one or more disk drives available for the reconstruction of redundant arrays (mirrored [RAID 1 and RAID 10] and parity [RAID 3, RAID 4, RAID 5, and RAID 50]). Once you assign a drive to the spare pool, it is not available for use as an array member or as a dedicated spare.

Pool spares are available to both SMs. If a drive in an array on either SM fails, the SM can use a pool spare to reconstruct the array.

If a pool spare is too small (smaller than an individual member in an array), the SM cannot use it.

E.3.1 Adding a Spare to the Spare Pool

You can add up to eight drives to the spare pool to reconstruct any critical array on the Galaxy 65 Subsystem. After an array has started using a pool spare, other critical arrays are prevented from using it. For a pool spare to be used, it must be at least as large as the smallest drive in the array.

To add a pool spare:

1. From the System Menu, select **Pool Spare Menu** and press **Enter**.
   The Pool Spare Menu displays.

2. Select **Add Pool Spare** and press **Enter**.
   The Select Drives screen displays.

   To blink the selected drive, press **B**. The blink function is a toggle. Press **B** again to stop the blinking. You can also blink more than one drive by selecting each drive and pressing **B**.

   To toggle the display between the drive model number, serial number, and the node and WWN, press **T**.

3. Select each spare drive you want to add and press **Enter.**

E.3.2 Deleting a Spare from the Spare Pool

You can delete a spare from the spare pool at any time.

To delete a spare from the spare pool:

1. From the System Menu, select **Pool Spare Menu** and press **Enter**.
   The Pool Spare Menu displays.

2. Select **Delete Pool Spare** and press **Enter**.
   The Delete Pool Spare screen displays listing the drives assigned to the spare pool.

3. Select the pool spare you want to delete and press **Enter.**

E.3.3 Displaying the Spare Pool

You can display a list of all of the pool spares.

To display the spare pool:

1. From the System Menu, select **Pool Spare Menu** and press **Enter**.
   The Pool Spare Menu displays.

2. Select **Display Pool Spares** and press **Enter**
   The Display Pool Spare screen displays listing all disk drives assigned to the spare pool.

3. Press **Esc** to return to the Pool Spare Menu.

Appendix F

Managing Disk Drives and Enclosures

Using the Disk Array Administrator, you can control a variety of functions related to disk drives and enclosure management processor (EMP) enclosures connected to your Galaxy 65 Subsystem.

- For drives, you can:
  - Display drive information (see page 173)
  - Clear metadata from a drive (see page 177)
  - Enable/disable write-back cache (see page 177)
  - Display disk cache status (see page 179)
  - Enable/disable changes to SMART (see page 181)
  - Blink a drive LED (see page 182)
  - Take down a drive (see page 182)
  - Test a drive (see page 183)

- For EMP enclosures, you can:
  - Change the EMP LUN (see page 184)
  - Change additional EMP settings (see page 187)

F.1 Managing Disk Drives

The Disk Array Administrator software lets you control a variety of functions related to disk drives. You should also refer to your disk drive or enclosure documentation for information about related functions.

F.1.1 Displaying Drive Information

You can display three types of information about disk drives:

- A list of all drives connected to the Galaxy 65 Subsystem
- The status of all drives in an array
- Errors on a specific drive and reset error statistics

F.1.1.1 Displaying All Drives

You can display a list of all connected drives. The information includes:

- Loop ID
- Size
- Vendor
- Model number (toggles with node WWN and serial number by pressing **T**)
- Node WWN (toggles with model number and serial number by pressing **T**)
- Serial number (toggles with node WWN and model number by pressing **T**)
- Drive firmware revision

If any of the drives are members of an array, the following information may also display:

- Utility running: Expand, Verify, etc.
- Array number: The array's sequential position in the Galaxy 65 Subsystem's array list
- Member number: The drive's sequential position in the array

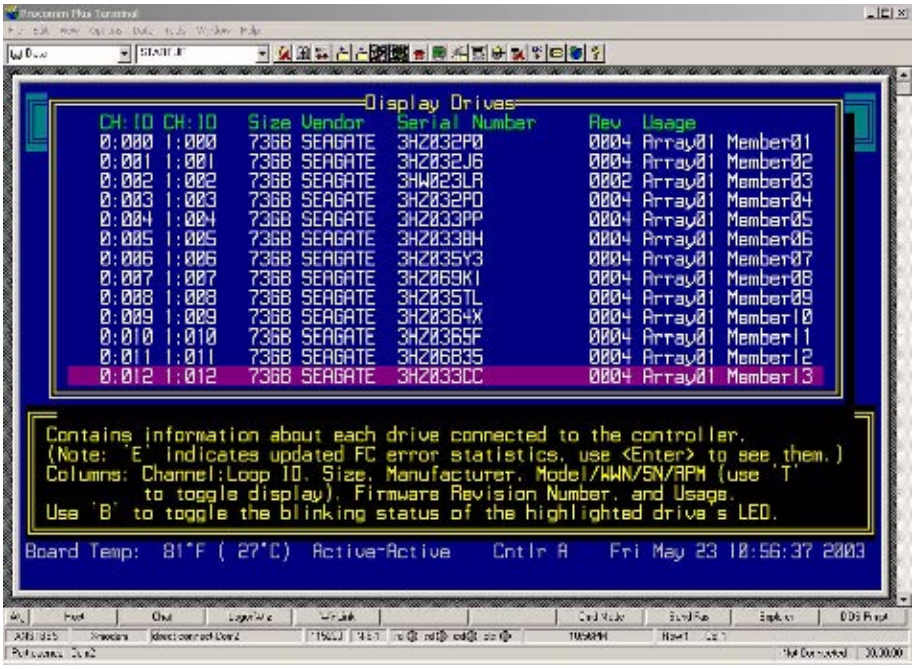
Drives that are not members of any array are listed as Available. Drives that contain leftover metadata from a previous array are listed as Leftover. This situation can arise if drives are removed and reinserted or the drives failed temporarily and are not operating again. To clear leftover metadata, use the Clear Metadata function. See F.1.2, "Clearing Metadata from a Drive", on page 177.

You can also perform two functions from the list of drives:

- View drive errors
- Blink the selected drive

To display all drives:

1 From the System Menu, select **Display Drives** and press **Enter**.
The Display Drives screen displays.


Display Drives
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:000 1:000 736B SEAGATE 3HZ032P0 0004 Array01 Member01
0:001 1:001 736B SEAGATE 3HZ032J6 0004 Array01 Member02
0:002 1:002 736B SEAGATE 3HW023LR 0002 Array01 Member03
0:003 1:003 736B SEAGATE 3HZ032PD 0004 Array01 Member04
0:004 1:004 736B SEAGATE 3HZ033PP 0004 Array01 Member05
0:005 1:005 736B SEAGATE 3HZ0338H 0004 Array01 Member06
0:006 1:006 736B SEAGATE 3HZ035Y3 0004 Array01 Member07
0:007 1:007 736B SEAGATE 3HZ069KI 0004 Array01 Member08
0:008 1:008 736B SEAGATE 3HZ035TL 0004 Array01 Member09
0:009 1:009 736B SEAGATE 3HZ0364X 0004 Array01 Member10
0:010 1:010 736B SEAGATE 3HZ0365F 0004 Array01 Member11
0:011 1:011 736B SEAGATE 3HZ06B35 0004 Array01 Member12
0:012 1:012 736B SEAGATE 3HZ033CC 0004 Array01 Member13
Contains information about each drive connected to the controller.
(Note: 'E' indicates updated FC error statistics, use <Enter> to see them.)
Columns: Channel:Loop ID, Size, Manufacturer, Model/WWN/SN/RPM (use 'T'
to toggle display), Firmware Revision Number, and Usage.
Use 'B' to toggle the blinking status of the highlighted drive's LED.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:56:37 2003

If a drive has an E in the first column, select the drive and press **Enter** to display the error.

To reset the error statistics, select **Reset drive error statistics** and press **Enter**.

To blink the selected drive, press **B**. The blink function is a toggle. Press **B** again to stop the blinking. You can also blink more than one drive by selecting each drive and pressing **B**.

To toggle the display between the drive model number, serial number, and the node and WWN, press **T**.

2 Press **Esc** to return to the System Menu.

F.1.1.2 Viewing Drive Status

You can view the status of the drives in an array, including the following information:

- Drive number: The drive's sequential position in the Galaxy 65 Subsystem's drive list
- Drive status: Whether the drive is up or down
- Spare: Displays SPR if the drive is a dedicated spare for the current array
- Channel number: Back-end disk bus number
- Channel and Loop ID: ID for the I/O modules the drive is connected to and the loop ID for the FC disk port

- Size: Size of the drive in MB
- Usage: If a member of an array, this displays the array name and member number. If a spare, this displays the type of spare. If unused, this displays Available. If the drive was part of an array that no longer exists, this displays Leftover.

Note If a drive has failed or malfunctioned, it may not be listed.

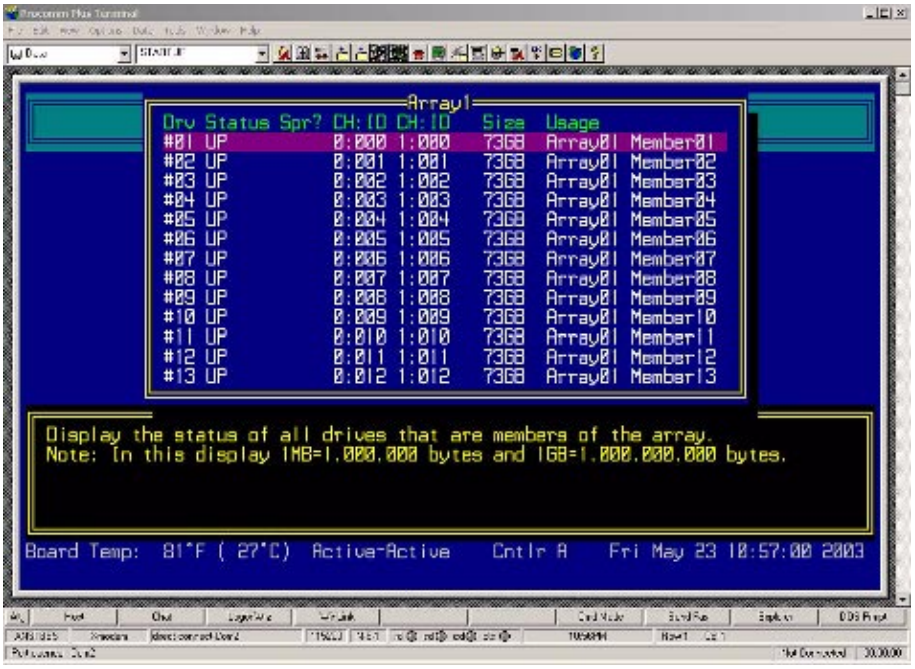
To view drive status:

1. From the System Menu, select **Array Menu** and press **Enter**.
   The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press **Enter**.
   The array menu displays.

3. Select **Drive Status** and press **Enter**.
   The drive status screen displays showing the drives that are members of the array and that are assigned as spares

   Use the ↑ or ↓ key to scroll through the drives.


Array1
Drv Status Spr? CH:ID CH:ID Size Usage
#01 UP 0:000 1:000 73GB Array01 Member01
#02 UP 0:001 1:001 73GB Array01 Member02
#03 UP 0:002 1:002 73GB Array01 Member03
#04 UP 0:003 1:003 73GB Array01 Member04
#05 UP 0:004 1:004 73GB Array01 Member05
#06 UP 0:005 1:005 73GB Array01 Member06
#07 UP 0:006 1:006 73GB Array01 Member07
#08 UP 0:007 1:007 73GB Array01 Member08
#09 UP 0:008 1:008 73GB Array01 Member09
#10 UP 0:009 1:009 73GB Array01 Member10
#11 UP 0:010 1:010 73GB Array01 Member11
#12 UP 0:011 1:011 73GB Array01 Member12
#13 UP 0:012 1:012 73GB Array01 Member13
Display the status of all drives that are members of the array.
Note: In this display 1MB=1,000,000 bytes and 1GB=1,000,000,000 bytes.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:57:00 2003

4. Press **Esc** to return to the Array Menu.

F.1.1.3 Displaying Drive Errors and Resetting Error Statistics

You can display drive errors for a specific drive. You know a drive has errors when you see the letter E in the first column of the Display Drives screen.

To display drive errors:

1. From the System Menu, select **Display Drives** and press **Enter**.
   The Display Drives screen displays.

2. If a drive has an E next to it, select the drive and press **Enter** to display the error information.

   Some errors are primarily for information purposes to help you diagnose drive and enclosure problems. For more information about SMART errors, refer to the drive manufacturer's specifications. For more information about FC errors, refer to: www.t11.org, click **Drafts**, find the *FC-FS 1.6 T11/02-018v0 dpANS - Fibre Channel Framing and Signaling Interface* document, and go to section 21.

   To reset the error statistics, select **Reset drive error statistics** and press **Enter**.

3. Press **Esc** to return to the list of drives.

F.1.2 Clearing Metadata from a Drive

All of the member drives in an array contain metadata in the first sectors of the drive. The Galaxy 65 Subsystem uses the metadata to identify array members after restarting or replacing an SM.

You can clear the metadata from a drive if you have a drive that was previously a member of an array. Drives in this state display Leftover in the Display Drives screen. After you clear the metadata, you can use the drive in an array or as a spare.

To clear metadata from a drive:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.

2. Select **Drive Utilities Menu** and press **Enter**.
   The Drive Utilities Menu displays.

3. Select **Clear Metadata** and press **Enter**
   The Select Drive screen displays showing drives that are not array members.

4. Select the drive you want and press **Enter**.
   You can now use this drive in an array or as a spare.

F.1.3 Enabling and Disabling Write-back Cache

You can control the write-back cache setting for all of your disk drives at once. Changes take effect after the next rescan or restart. A change to this setting on either SM is automatically updated on the other SM.

This can be set to ENABLE, DISABLE, or DON'T MODIFY (which means the Galaxy 65 Subsystem should not change any drive's write-back cache settings). The default setting is DISABLE.

Typically, if your drives are part of an array, you do not want to turn on write-back cache on the drives. The Galaxy 65 Subsystem is already using write-back cache to improve performance. Turning on write-back cache on the disk drive *may* improve performance in some cases, depending on the type of array and how you are using it.

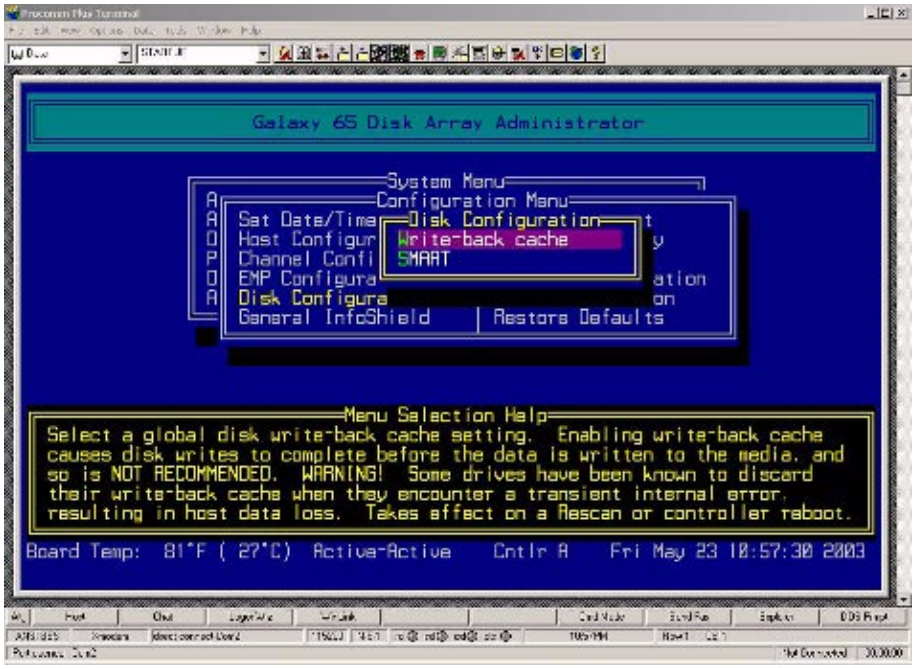
Any disk drives with write-back cache enabled should be connected to an Uninterruptible power supply (UPS) in case of power failure. If the drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk's write-back cache.

Caution *We recommend that you disable disk write-back cache. Some drives delete their write-back cache if they encounter an internal error, resulting in lost data.*

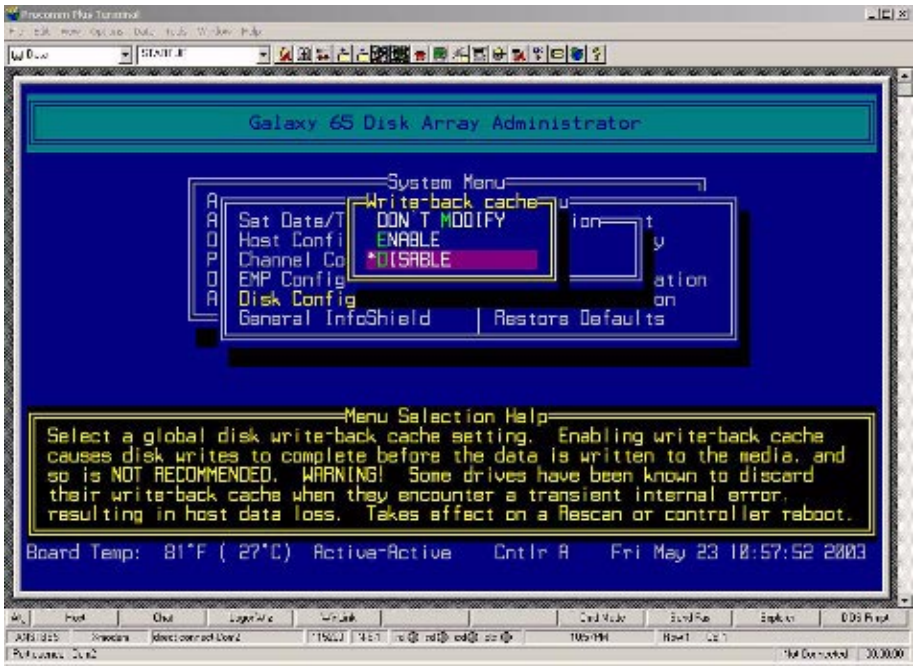
To change the write-back cache setting:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

Select **Disk Configuration** and press **Enter**.
The Disk Configuration screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Disk Configuration
Write-back cache
SMART
Restore Defaults
Menu Selection Help
Select a global disk write-back cache setting. Enabling write-back cache causes disk writes to complete before the data is written to the media, and so is NOT RECOMMENDED. WARNING! Some drives have been known to discard their write-back cache when they encounter a transient internal error, resulting in host data loss. Takes effect on a Rescan or controller reboot.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:57:30 2003

2 Select **Write-back Cache** and press **Enter**.
The Write-back Cache screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
Write-back cache
DON'T MODIFY
ENABLE
*DISABLE
Sat Date/T
Host Confi
Channel Co
EMP Config
Disk Config
General InfoShield
Restore Defaults
Menu Selection Help
Select a global disk write-back cache setting. Enabling write-back cache causes disk writes to complete before the data is written to the media, and so is NOT RECOMMENDED. WARNING! Some drives have been known to discard their write-back cache when they encounter a transient internal error, resulting in host data loss. Takes effect on a Rescan or controller reboot.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:57:52 2003

3 Select the option you want and press **Enter**.

4 Restart or rescan to have your changes take effect.

See G.1.1, ”Shutting Down and Restarting the Current SM Module”, on page 190 or G.10, ”Rescanning All Channels”, on page 206.

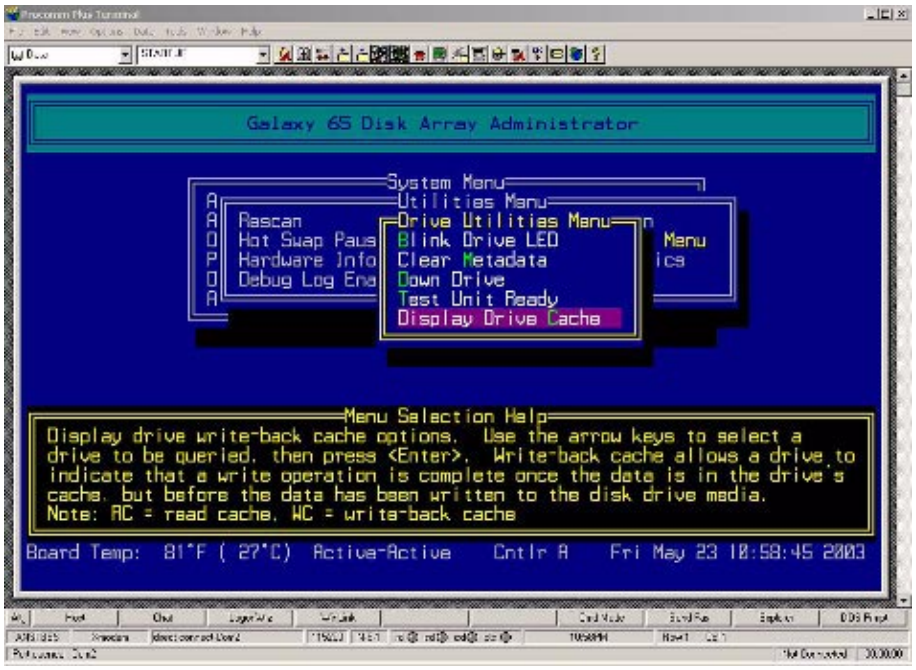
F.1.4 Displaying Disk Cache Status

You can display the cache status of each disk drive. Any disk drives with write-back cache enabled should be connected to a UPS in case of power failure. If the drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk’s write-back cache.

To display disk cache status:

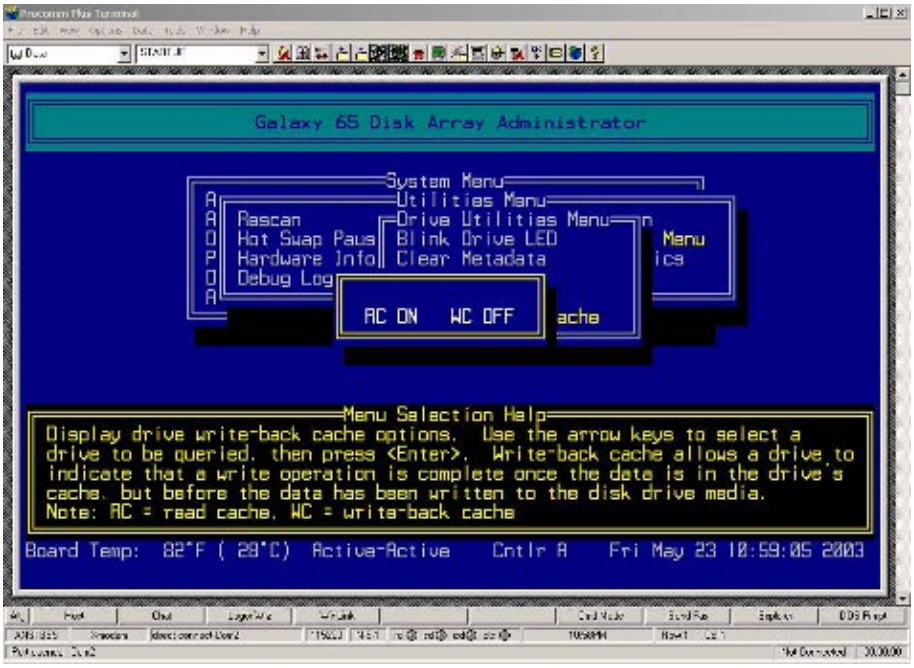
1 From the System Menu, select **Utilities Menu** and press **Enter**.
The Utilities Menu displays.

2 Select **Drive Utilities Menu** and press **Enter**.
The Drive Utilities Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Utilities Menu
Drive Utilities Menu
Rescan
Hot Swap Paus
Hardware Info
Debug Log Ena
Blink Drive LED
Clear Metadata
Down Drive
Test Unit Ready
Display Drive Cache
Menu Selection Help
Display drive write-back cache options. Use the arrow keys to select a drive to be queried, then press <Enter>. Write-back cache allows a drive to indicate that a write operation is complete once the data is in the drive's cache, but before the data has been written to the disk drive media.
Note: RC = read cache, WC = write-back cache
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 10:58:45 2003

3 Select **Display Drive Cache** and press **Enter**
The Select Drives screen displays.

4 Select a drive and press **Enter**.
The cache status screen displays showing the status of the read and write cache.


Galaxy 65 Disk Array Administrator
System Menu
Utilities Menu
Drive Utilities Menu
Rescan
Hot Swap Paus
Hardware Info
Debug Log
Blink Drive LED
Clear Metadata
RC ON WC OFF
Menu Selection Help
Display drive write-back cache options. Use the arrow keys to select a drive to be queried, then press <Enter>. Write-back cache allows a drive to indicate that a write operation is complete once the data is in the drive's cache, but before the data has been written to the disk drive media.
Note: RC = read cache, WC = write-back cache
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 10:59:05 2003

5 Press **Esc** to return to the Drive Utilities Menu.

F.1.5 Enabling and Disabling SMART Changes

You can enable or disable the ability to change the Self-Monitoring, Analysis and Reporting Technology (SMART) settings for all drives connected to the Galaxy 65 Subsystem. This can be set to ENABLE, DISABLE, or DON'T MODIFY (which means the Galaxy 65 Subsystem should not change any drive's SMART settings). The default setting is DON'T MODIFY.

When you enable SMART, the SMART events are recorded in the event log, which lets you monitor your disk drives or analyze why a drive failed. For more information, see D.2, "Displaying the Event Log", on page 154. On most drives, SMART is disabled by default by the manufacturer.

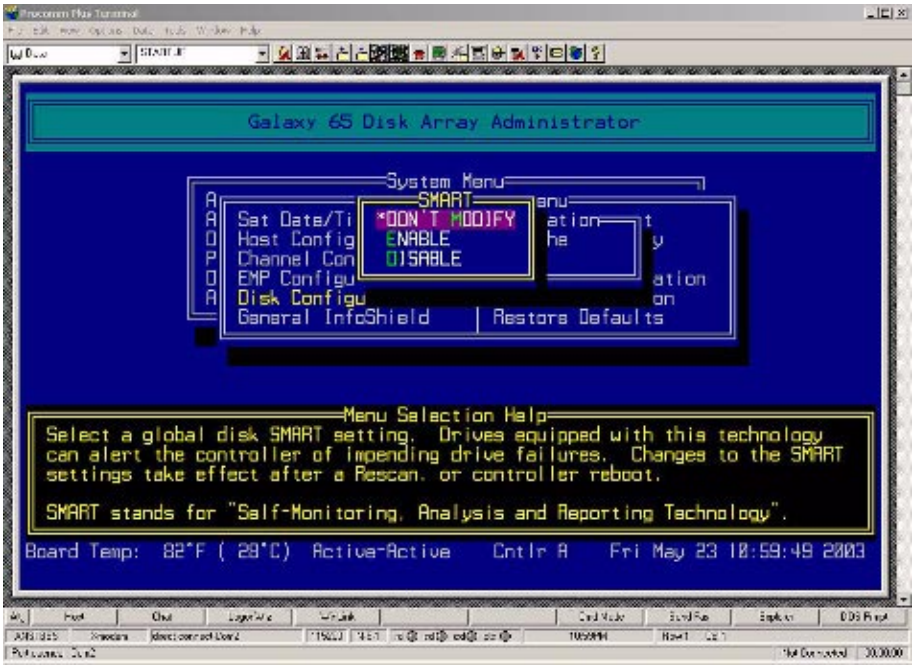
A change to this setting on either SM module is automatically updated on the other SM module.

To enable or disable SMART changes:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Disk Configuration** and press **Enter**.
The Disk Configuration screen displays.

3 Select **SMART** and press **Enter**.
The SMART screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
SMART
*DON'T MODIFY
ENABLE
DISABLE
Set Date/Ti
Host Config
Channel Con
EMP Configu
Disk Configu
General InfoShield
Restore Defaults
Menu Selection Help
Select a global disk SMART setting. Drives equipped with this technology can alert the controller of impending drive failures. Changes to the SMART settings take effect after a Rescan, or controller reboot.
SMART stands for "Self-Monitoring, Analysis and Reporting Technology".
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 10:59:49 2003

4 Select the option you want and press **Enter**.

5 Restart or rescan to have your changes take effect.

See G.1, "Shutting Down and Restarting the Storage Manager Module", on page 190 or G.10, "Rescanning All Channels", on page 206.

F.1.6 Blinking a Drive LED

You can blink the LED on a specific drive one of two ways:

- From the Drive Utilities Menu (only works for a single drive; see below)
- From the Display Drives list when you add a pool spare or display all drives (works for multiple drives). Select the drive and press **B**. Press **B** again to stop the blinking.

To blink a drive LED from the Drive Utilities Menu:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press **Enter**.
   The Drive Utilities Menu displays.
3. Select **Blink Drive LED** and press **Enter**
   The Select Drive screen displays.
4. Select the drive you want and press **Enter**.
   The drive continues blinking its LED until you do one of the following:
   - Press **Esc** before the Disk Array Administrator times out.
   - Repeat the blink LED command, which toggles the blink LED command off.
5. Press **Esc** to stop blinking the LED.

F.1.7 Taking Down a Drive

Caution *This function is only for testing and could result in data loss. It should not be used in normal operation.*

The Down Drive function sets the status of a drive in a fault-tolerant array to down. This forces the Galaxy 65 Subsystem to remove it from the array and marks the array as critical. At this point, you will be unable to take down any additional drives in the array.

If you have a properly sized dedicated or pool spare, this will cause a reconstruct on the affected array. For more information, see C.2.5, ”Reconstructing an Array”, on page 126.

To take down a drive:

1. From the System Menu, select **Utilities Menu** and press **Enter**.
   The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press **Enter**.
   The Drive Utilities Menu displays.
3. Select **Down Drive** and press **Enter**
   The Select Drive screen displays showing drives that are array members.

4 Select the drive you want and press **Enter**.
The system confirms that you want to make the change.

5 Select **Yes** and press **Enter** to make the change.

To make the drive display again, you must use Rescan. See G.10, ”Rescanning All Channels”, on page 206. After you rescan, you must clear the metadata from the drive before you can use it in an array or as a spare. See F.1.2, ”Clearing Metadata from a Drive”, on page 177.

F.1.8 Testing a Drive

This function issues a Test Unit Ready (TUR) command to the selected disk. This just tells you that the drive can respond, but it still may not be functioning properly.

To test a drive:

1 From the System Menu, select **Utilities Menu** and press **Enter**.
The Utilities Menu displays.

2 Select **Drive Utilities Menu** and press **Enter**.
The Drive Utilities Menu displays.

3 Select **Test Unit Ready** and press **Enter**.
The Select Drive screen displays.

4 Select the drive you want and press **Enter**.

If the TUR was successful, TUR STATUS OK displays.

If the TUR was not successful, a failure message displays.

5 Press **Esc** to return to the Drive Utilities Menu.

F.2 Managing Enclosures

An enclosure management processor (EMP) is a device in the enclosure from which the Galaxy 65 Subsystem can inquire about the enclosure’s environmental conditions such as temperature, power supply and fan status, and the presence or absence of disk drives. The Galaxy 65 Subsystem can also tell the EMP about RAID activities such as drive rebuilds and failed disk drives.

If you have only one EMP, the configuration settings are automatically enabled when the Galaxy 65 Subsystem is installed. No changes are required to the default configuration settings to support EMP.

If you have more than one EMP, you must set up the EMP LUNs as described in the next section.

- Set the EMP LUN (see page 184)
- Change additional EMP setting (see page 187):
  - Polling interval

F.2.1 Setting the EMP LUN

If you have only one EMP, the configuration settings are automatically enabled when the Galaxy 65 Subsystem is installed.

If you have more than one EMP, you must set up the EMP LUNs as described in this section.

The Galaxy 65 Subsystem allows in-band access to the EMP in the disk enclosure under the Galaxy 65 Subsystem's target ID using direct EMP commands. You can set an EMP LUN to any value between 0 and 63, except where it would conflict with a previously assigned LUN (EMP, array, or CAPI [Galaxy 65]). You can also set it to NONE, which tells the Galaxy 65 Subsystem not to present a LUN for this EMP under the Galaxy 65 Subsystem's target ID.

You can set LUNs for EMPs that you plan to add by assigning a LUN to the EMP ID you want to use. The Galaxy 65 Subsystem assigns EMP IDs sequentially each time it starts.

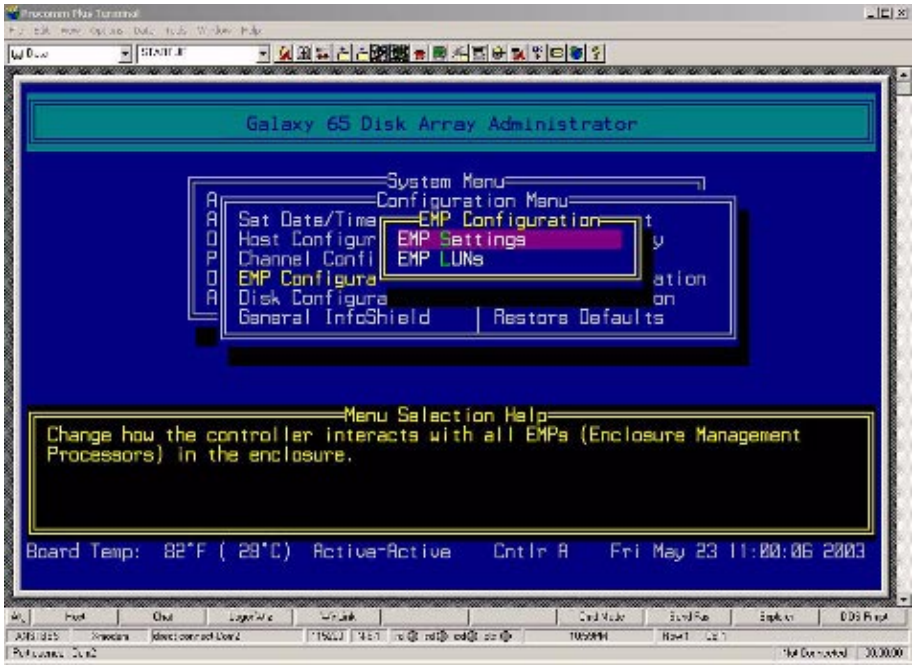
Note EMP LUN settings have no effect on the CAPI interface, which always allows communication with all of the EMPs connected to the Galaxy 65 Subsystem.

You may want to change the EMP LUN if it conflicts with the LUN of another device.

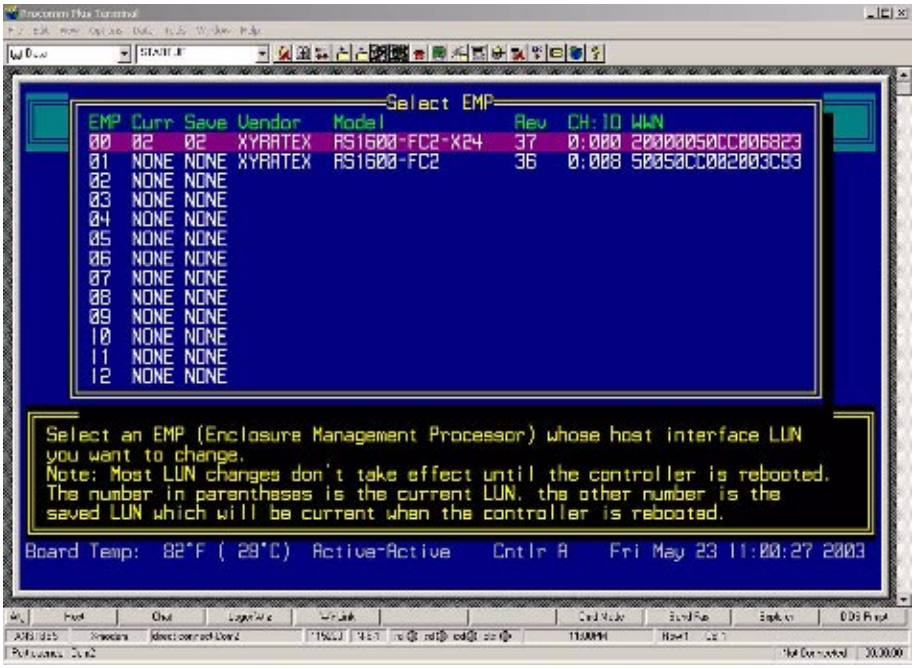
To change the EMP LUN:

1. From the System Menu, select **Configuration Menu** and press **Enter**.
   The Configuration Menu displays.

2. Select **EMP Configuration** and press **Enter**.
   The EMP Configuration screen displays.



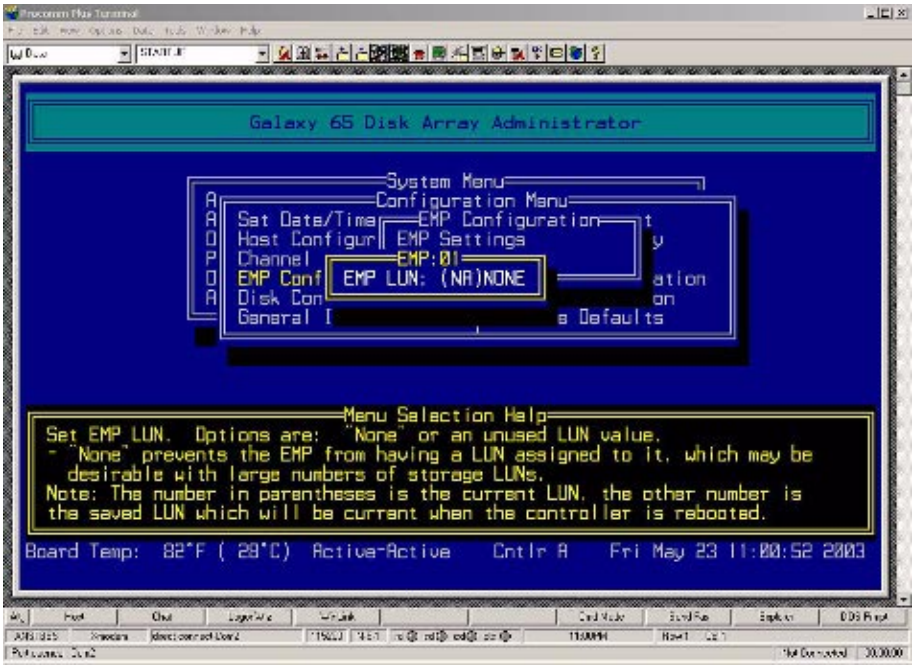
3 Select **EMP LUNs** and press **Enter**.
The EMP LUNs screen displays.


Select EMP
EMP Curr Save Vendor Model Rev CH:ID WWN
00 02 02 XYRATEX RS1600-FC2-X24 37 0:000 20000050CC006823
01 NONE NONE XYRATEX RS1600-FC2 36 0:008 50050CC002003C93
02 NONE NONE
03 NONE NONE
04 NONE NONE
05 NONE NONE
06 NONE NONE
07 NONE NONE
08 NONE NONE
09 NONE NONE
10 NONE NONE
11 NONE NONE
12 NONE NONE
Select an EMP (Enclosure Management Processor) whose host interface LUN you want to change.
Note: Most LUN changes don't take effect until the controller is rebooted.
The number in parentheses is the current LUN. the other number is the saved LUN which will be current when the controller is rebooted.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:00:27 2003

4 Select the EMP you want and press **Enter**.

The Galaxy 65 Subsystem assigns EMP IDs sequentially when it starts.

The EMP LUN screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Set Date/Time
Host Configur
Channel
EMP Conf
Disk Con
General
EMP Configuration
EMP Settings
EMP:01
EMP LUN: (NA)NONE
Menu Selection Help
Set EMP LUN. Options are: "None" or an unused LUN value.
"None" prevents the EMP from having a LUN assigned to it, which may be desirable with large numbers of storage LUNs.
Note: The number in parentheses is the current LUN, the other number is the saved LUN which will be current when the controller is rebooted.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:00:52 2003

5 Select the option or number you want to use.

To	Do this
Not assign the EMP a LUN	Select **NONE** and press **Enter**.
Keep the same LUN for the EMP at all times	Select the [LUN] you want to use and press **Enter**. This can be any number from 0 to 63 that is not already in use.

The system confirms that you want to make the change.

6 Select **Yes** and press **Enter** to make the change.

7 Restart to have your changes take effect.

See G.1.1, "Shutting Down and Restarting the Current SM Module", on page 190.

F.2.2 Changing the Additional EMP Setting

You can change one additional EMP setting:

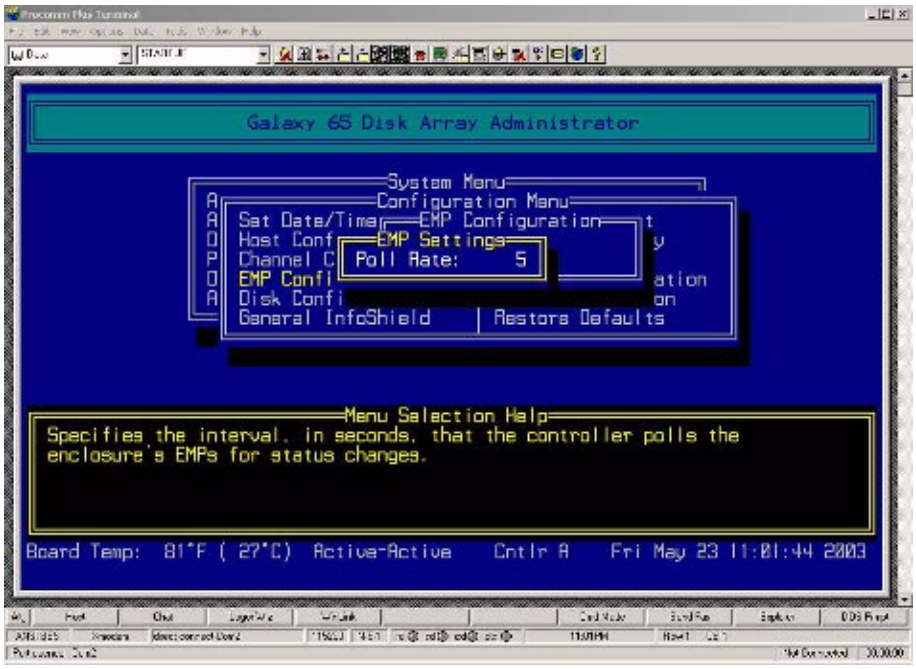
- **Polling interva**l: This is the interval, in seconds, that the Galaxy 65 Subsystem polls the EMPs for status changes. If the polling rate is set to zero, the Galaxy 65 Subsystem does not communicate with the EMP. Only use this setting if you suspect you are having communication problems with the EMP. The default setting is five seconds. A change to this setting on either SM is automatically updated on the other SM.

To change the EMP settings:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select EMP **Configuration** and press **Enter**.
The EMP Configuration screen displays.

3 Select **EMP Settings** and press **Enter**.
The Poll Rate screen displays.



4 Enter the poll rate you want, in seconds, and press **Enter**.

The system confirms that you want to make the changes.

5 Select **Yes** and press **Enter** to make the changes.

Appendix G

Configuring the Galaxy 65 Subsystem

Using the Disk Array Administrator, you can configure settings and perform a variety of functions on the Galaxy 65 Subsystem. You can:

- Shut down and restart the Storage Manager module (see page 190)
- Change the date and time (see page 192)
- View LUN information (see page 196)
- Configure the FC disk channels (see page 198)
- Change the alarm mute setting (see page 200)
- Lock the cache setting (see page 203)
- Enable or disable the battery (see page 204)
- Change the utility priority (see page 205)
- Rescan all channels (see page 206)
- Pause I/O (see page 207)
- Restore the default settings (see page 208)
- Upgrade the firmware (see page 209)

G.1 Shutting Down and Restarting the Storage Manager Module

- **Shut down and restart the current SM module**: Gracefully shuts down and restarts the SM module you are currently accessing using the Disk Array Administrator software (as shown at the bottom of each screen). Use this option when you have changed a configuration that requires restarting (the procedures say when you need to do this) or when you need to replace the SM module. (See page 190.)

- **Shut down the other SM module**: Gracefully shuts down the other SM module (the one you are not currently accessing using the Disk Array Administrator software). Use this option when you need to replace the other SM module or to perform maintenance. (See page 191.)

- **Shut down both SM modules**: Gracefully shuts down both SM modules. Use this option when you need to power down the whole system for maintenance, repair, or a move. (See page 192.)

G.1.1 Shutting Down and Restarting the Current SM Module

You may need to shut down and restart a SM module after making certain configuration changes. The procedures say when you need to do this.

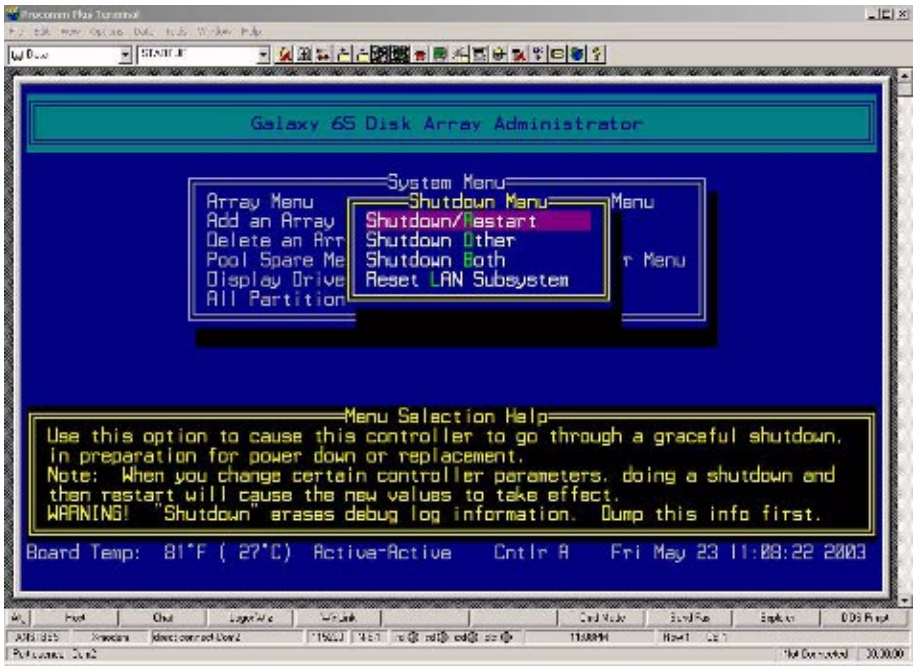
You should shut down a SM module before you remove it. This shut down is the same as unlocking the handles on the SM module hardware to remove it. Using the shutdown from the Disk Array Administrator lets you see any messages related to the shut down. You cannot see the messages when you unlock the hardware handles.

You should shut down both SM modules when you need to power down the whole system for maintenance, repair, or a move. For more information, see G.1.3, ”Shutting Down Both SM Modules”, on page 192.

We strongly recommend that you shut down a SM module gracefully and do not just turn off the power. A normal shutdown ensures that the write-back cache has been flushed to the disk.

To shut down and restart the current SM:

1 From the System Menu, select **Shutdown Menu** and press **Enter**
The Shutdown Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Arr
Pool Spare Me
Display Drive
All Partition
Shutdown Menu
Shutdown/Restart
Shutdown Other
Shutdown Both
Reset LAN Subsystem
Menu
r Menu
Menu Selection Help
Use this option to cause this controller to go through a graceful shutdown,
in preparation for power down or replacement.
Note: When you change certain controller parameters, doing a shutdown and
then restart will cause the new values to take effect.
WARNING! "Shutdown" erases debug log information. Dump this info first.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 11:08:22 2003

2 Select **Shutdown/Restart** and press **Enter**
The system confirms that you want to shut down

3 .Select **Yes** and press **Enter**.
The system confirms that it has shut down.

To restart the SM, press **Enter** to restart.

The system performs its self-test. When you see the Disk Array Administrator initial screen, the SM is ready.

G.1.2 Shutting Down the Other SM Module

You should shut down the other SM module when you need to remove the other SM module. This shut down is the same as unlocking the handles on the SM module hardware to remove it. Using the shutdown from the Disk Array Administrator lets you see any messages related to the shut down. You cannot see the messages when you unlock the hardware handles.

You should shut down both SM modules when you need to power down the whole system for maintenance, repair, or a move. For more information, see G.1.3, ”Shutting Down Both SM Modules”, on page 192.

We strongly recommend that you shut down the SM module gracefully and do not turn off the power. A normal shutdown ensures that the write-back cache is flushed to the disk.

To shut down the other SM module:

1 From the System Menu, select **Shutdown Menu** and press **Enter**
The Shutdown Menu displays.

2 Select **Shutdown Other** and press **Enter**
The system confirms that you want to shut down.

3 Select **Yes** and press **Enter**.
The system confirms that it has shut down.

G.1.3 Shutting Down Both SM Modules

You can simultaneously and gracefully shut down *both* SM modules. Use this in preparation to power down the whole system for maintenance, repair, or a move.

Caution *Shutting down both SMs will cause users to lose access to data and will interrupt the flow of data.*

To shut down both SM modules:

1 From the System Menu, select **Shutdown Menu** and press **Enter**
The Shutdown Menu displays.

2 Select **Shutdown Both** and press **Enter**
The system confirms that you want to shut down.

3 Select **Yes** and press **Enter**.
Both SMs shut down.

To restart both SM modules, press **Enter** at the same time on both SM modules.

G.1.4 Other Controller Menu

In addition to the previous shutdown menu, "other controller menu" gives the ability to kill or unkill the other SM module, as well as shut down the other or both SM modules.

Caution *If the* SM module *is the only one working of the redundant pair, then killing the other* SM module *will cause users to lose access to data and will interrupt the flow of data.*

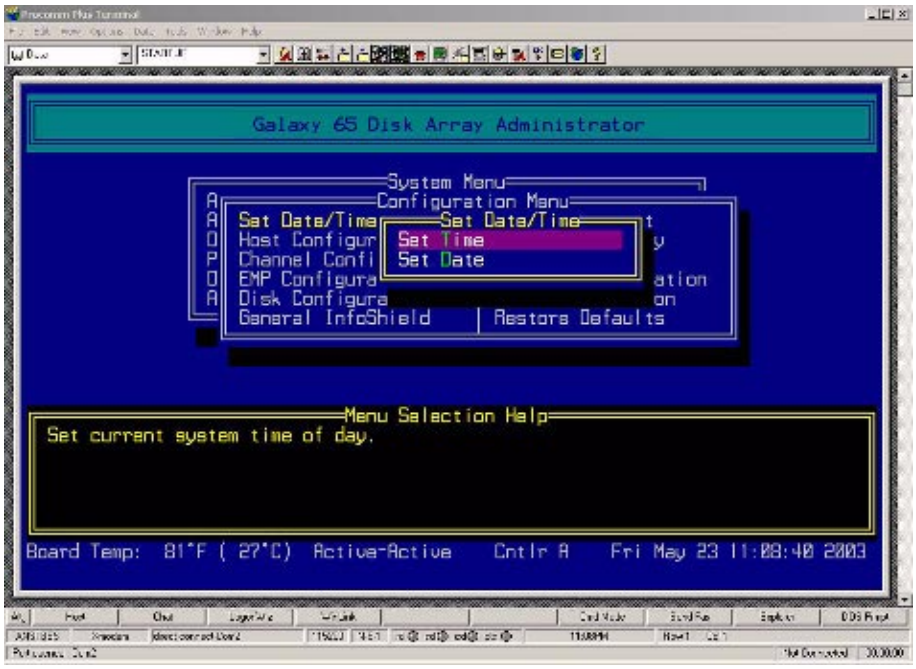
G.2 Changing the Date and Time

You can change the date and time on either SM module. A change to this setting on either SM module is automatically updated on the other SM module.

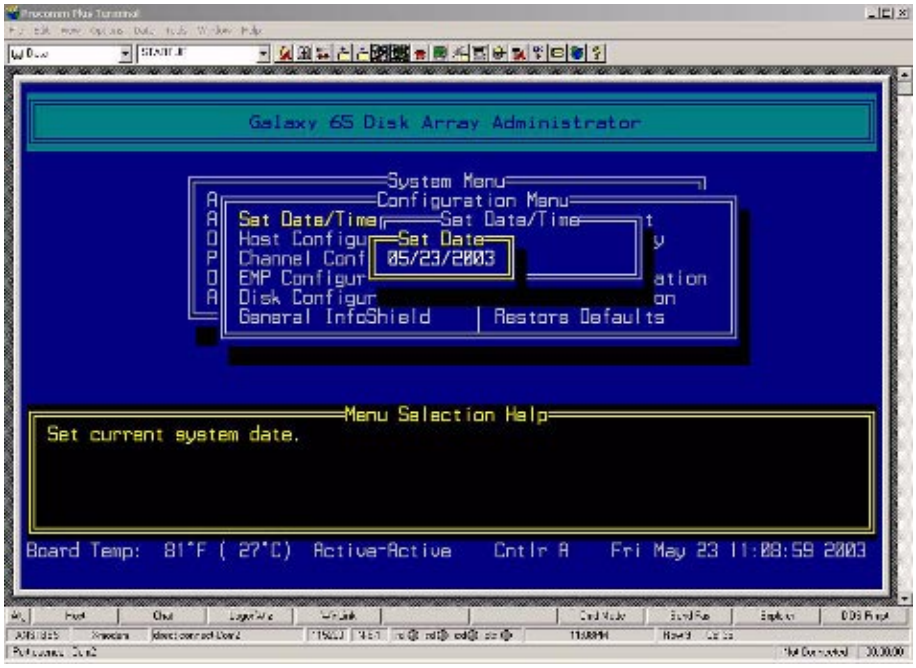
To set an SM module's date:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Set Date/Time** and press **Enter**
The Set Date/Time screen displays.



3 Select **Set Date** and press **Enter**.
The Set Date screen displays



4 Enter the date you want and press **Enter**.

Enter the date in the following format: MM/DD/YYYY.

The system confirms that you want to make the change.

5 Select **Yes** and press **Enter** to make the change.

The system confirms that the change is made.

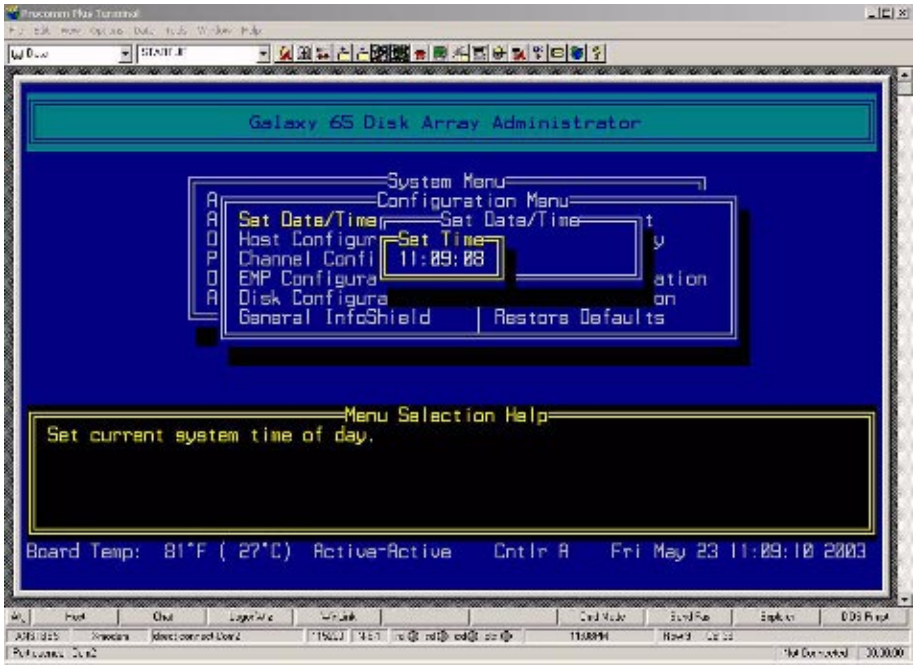
6 Press **Esc** to return to the Configuration Menu.

To set an SM module's time:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Set Date/Time** and press **Enter**
The Set Date/Time screen displays.

3 Select **Set Time** and press **Enter**.
The Set Time screen displays



4 Enter the time you want and press **Enter**.
(Enter the time using a 24-hour clock in the following format: hh:mm:ss).
The system confirms that you want to make the change.

5 Select **Yes** and press **Enter** to make the change.
The system confirms that the change is made.

6 Press **Esc** to return to the Configuration Menu.

G.3 Configuring the Host Channels

You can configure several settings for each host channel independently.

Table 7–1 lists the host channel settings and what they do.

Table 7–1 Host channel settings

Host channel setting	Description
Topology	You should be sure that the topology setting is correct for your configuration. You can set the topology to: • LOOP—Use this option for all configurations except when the SM module is connected to a switch F-port. You must use this option if the internal hubs are enabled. • .POINT-TO-POINT—Use this option only when you connect the SM module to a switch F-port. If you change from Loop to Point to Point mode after already establishing a public loop connection, the switch may ignore subsequent attempts to perform point to point initialization. To resolve this, see 7.9, ”Host Fibre Channel Problems”, on page 67
Link Speed	You can set the speed to: 1 GB or 2 GB. When you change the link speed, the other host channel on this I/O module changes speed to match.

Table 7–1 Host channel settings (Continued)

Host channel setting	Description
Target ID	FC Loop ID—You may need to change the FC Loop ID if you want the SM module to be at a specific address or if your system checks addresses in reverse order (lowest address first). You have two options: • SOFT—Use this setting if you do not care whether the SM module's Loop ID changes when you power down and power up. This setting lets the FC loop initialization process determine the Loop ID. • Any number between 0 and 125—Select a specific number if you want the Loop ID to stay the same after you power down and power up. The Disk Array Administrator software cannot tell you which Loop IDs are available. To be sure that you have successfully assigned the Loop ID you want, check the Loop ID after you restart the SM module. If the SM module cannot get the specified Loop ID during the loop initialization process, it will try to get a soft address.
CAPI LUN For more information about LUNs, see <Chap Blue 10 pt><Emphasis>Understanding LUNs and Viewing LUN Information on page 196.	Each SM module has one LUN that you can change when you configure the host channels. You only need to assign a CAPI LUN if you are using CAPI to configure the Galaxy 65 Subsystem over a host channel via SCSI protocol extensions. If you are not using CAPI, you can set the CAPI LUN to NONE. If you are using CAPI, you can set it to a value of 0-63. You have two options for setting the LUN: • NONE—Use this setting if you are not using CAPI to configure the Galaxy 65 Subsystem. • Any number between 0 and 63—Select a specific number if you want the CAPI LUN to stay the same when you restart (this change takes effect immediately unless the CAPI LUN is currently in use).

To configure the host channels:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Host Configuration** and press **Enter**.
The Select Host Channel screen displays.

3 Select the host channel you want to configure and press **Enter**.
The Topology screen displays. An * displays next to the current setting.

4 Select the option you want and press **Enter**.
The Link Speed screen displays. An * displays next to the current setting.

5 Select the option you want and press **Enter**.
The Target ID screen displays.

6 Select the option or number you want and press **Ente**r.
The CAPI LUN screen displays.

7 Select the option or number you want to use.
There is just one CAPI LUN for each SM module. The system confirms that you want to make the change.

8 Select **Yes** and press **Enter** to make the changes.

G.4 Understanding LUNs and Viewing LUN Information

Each SM module supports up to 64 FC logical unit numbers (LUNs), or 128 after a failover, that are numbered zero through 63. There are three different types of LUNs: CAPI, EMP, and partition. You can view information about each LUN. See G.4.1, ”Viewing LUN Information”, on page 197.

The three types of LUNs have the following characteristics:

- **CAPI LUN**: Allows CAPI to configure the SM module. Each Galaxy 65 can have a CAPI LUN. You only need to assign a CAPI LUN if you are using CAPI to configure the Galaxy 65 over a host channel using SCSI protocol extensions. If you are not using CAPI, you can set the CAPI LUN to NONE. If you are using CAPI, you can set it to a value of 0-63. For more information about changing the CAPI LUN, see G.3, ”Configuring the Host Channels”, on page 195.

  Note: Most UNIX, Linux, and Macintosh operating systems require that the CAPI LUN be set to a higher value than all array LUNs. Before creating your first array, change the CAPI LUN to a higher value. If you are using a custom software application to configure and manage the controller (this application uses CAPI to communicate with the controller), you must have a CAPI LUN. If you are not using a custom application, and therefore are not using CAPI, select NONE as the CAPI LUN. This allows your first array to be seen at LUN 0.

- **EMP LUNs**: Allow access to EMPs. You can set an EMP LUN to a value of 0-63 or NONE. NONE means that the EMP cannot be accessed via a LUN. For information about changing the EMP LUN, see F.2.1, ”Setting the EMP LUN”, on page 184.

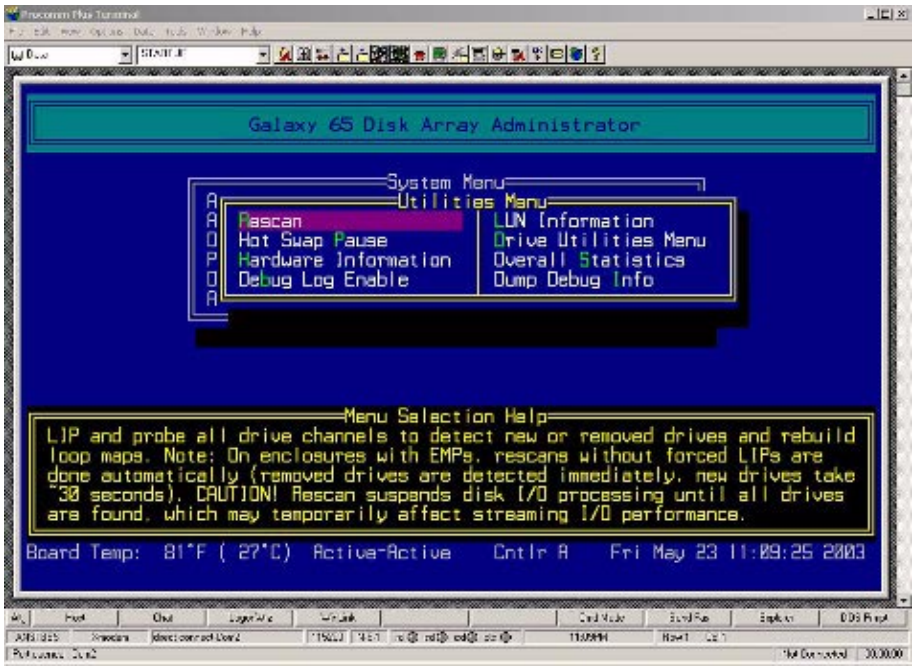
- **Partition LUNs**: Allow access to partitions on the SM module. You can set partition LUNs to any numeric value from 0-63. For information about changing the partition LUN, see C.3.5, ”Changing a Partition LUN”, on page 141.

G.4.1 Viewing LUN Information

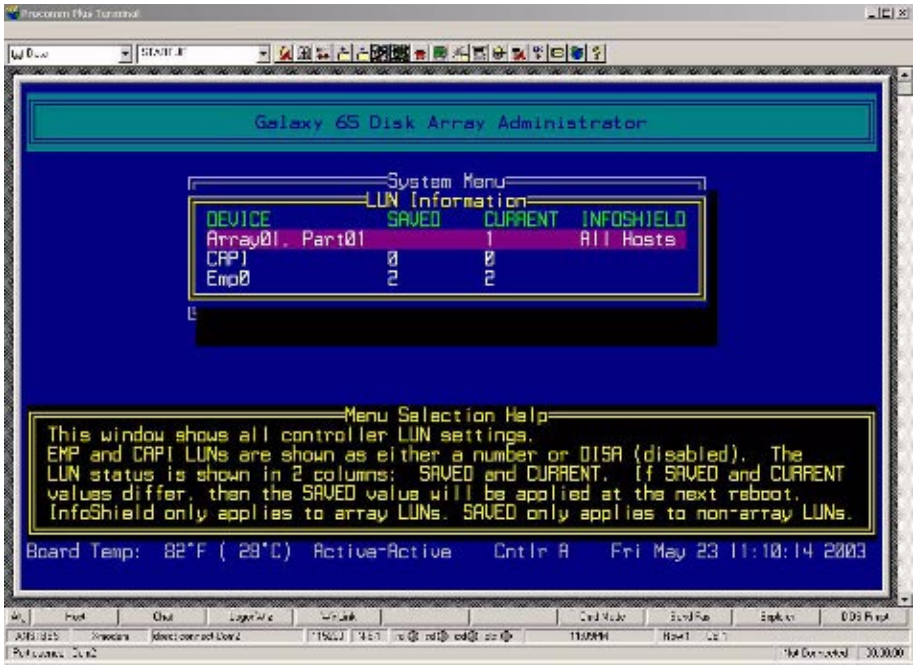
You can view information for each existing LUN.

To view LUN information:

1 From the System Menu, select **Utilities Menu** and press **Enter**.
The Utilities Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Utilities Menu
Rescan
Hot Swap Pause
Hardware Information
Debug Log Enable
LUN Information
Drive Utilities Menu
Overall Statistics
Dump Debug Info
Menu Selection Help
LIP and probe all drive channels to detect new or removed drives and rebuild loop maps. Note: On enclosures with EMPs, rescans without forced LIPs are done automatically (removed drives are detected immediately, new drives take ~30 seconds). CAUTION! Rescan suspends disk I/O processing until all drives are found, which may temporarily affect streaming I/O performance.
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 11:09:25 2003

2 Select **LUN information** and press **Enter**
The LUN Information screen displays.


Galaxy 65 Disk Array Administrator
System Menu
LUN Information
DEVICE SAVED CURRENT INFOSHIELD
Array01, Part01 1 All Hosts
CAP1 0 0
Emp0 2 2
Menu Selection Help
This window shows all controller LUN settings.
EMP and CAP1 LUNs are shown as either a number or DISA (disabled). The LUN status is shown in 2 columns: SAVED and CURRENT. If SAVED and CURRENT values differ, then the SAVED value will be applied at the next reboot.
InfoShield only applies to array LUNs. SAVED only applies to non-array LUNs.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:10:14 2003

3 Press **Esc** to return to the Utilities Menu.

G.5 Configuring the FC Disk Channels

You can change two configuration options for each FC disk channel:

- **Link speed**: This is the maximum speed the Galaxy 65 Subsystem will attempt to negotiate. You can set the speed to: 1 GB/second or 2 GB/second. The Link Speed setting is set on the Ops Panel switches, as shown in Figure 7–1 and defined in Table 7–2.

Caution *All mandatory settings must be observed in order for the Galaxy 65 system to function correctly.*

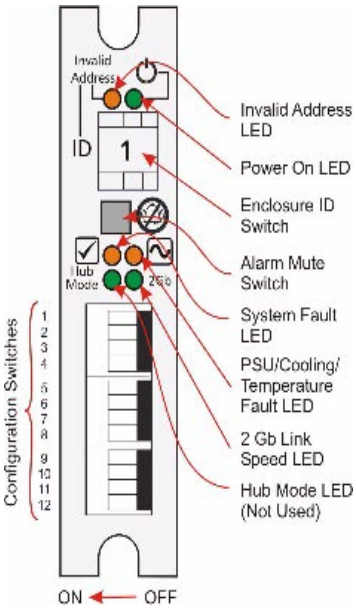


Figure 7–1 Ops Panel LEDs and Switches

Table 7–2 Ops Panel Switch Functions

Switch Number	Function	Recommended Setting		Definition
1	Loop Select, Dual (2x8)	Off		LRC operates on two loops of 8 drives Mandatory
2	Not Used	Note: on Expansion enclosures this must be set On.		
3	Not Used			
4	Not Used			
5 & 6	Not Used			
7 & 8	Drive Loop Speed Select	*Sw7*	*Sw8*	
		On	Off	Force 2Gb/s
		Off	Off	Force 1Gb/s
9 & 10	Drive Addressing Mode Selection	*Sw9*	*Sw10*	
		On	Off	Mode 2
11	SOFT SELECT	On		Select Functions using the hardware switches
12	Not Used			

- **Initiator ID assigned to each channel**: The Galaxy 65 Subsystem assigns each of its FC disk channels one of the FC loop IDs (initiator IDs). The Initiator ID setting is set via the Disk Array Administrator. You can change the initiator ID assigned to each channel. You may need to do this if the default ID, 125, conflicts with an EMP ID. You have two options:

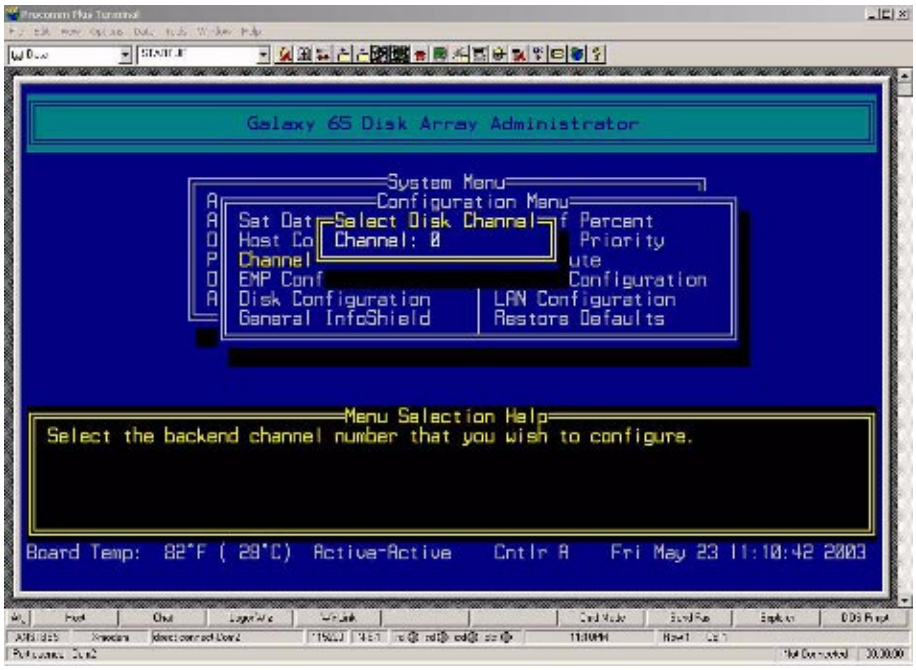
  – SOFT: Use this setting if you do not care whether the channel's initiator ID changes when you power down and power up. This setting lets the FC loop initialization process determine the initiator ID.

  – Any number between 0 and 125: Select a specific number if you want the initiator ID to stay the same after you power down and power up. The Disk Array Administrator software cannot tell you which IDs are available. To be sure that you have successfully assigned the ID you want, check the ID after you restart the Galaxy 65 Subsystem. If the Galaxy 65 Subsystem cannot get the specified Loop ID during the loop initialization process, it will try to get a soft address.

To configure the FC disk channels:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Channel Configuration** and press **Enter**.
The Select Disk Channel screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Select Disk Channel
Channel: 0
Disk Configuration
LAN Configuration
General InfoShield
Restore Defaults
Menu Selection Help
Select the backend channel number that you wish to configure.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:10:42 2003

3 Select the channel you want and press **Enter**.

4 Select the initiator ID you want and press **Enter**.
The system confirms that you want to make the changes.

5 Select **Yes** and press **Enter** to make the changes.

6 Press **Esc** to return to the Configuration Menu.

G.6 Changing the Alarm Mute Setting

You can enable or disable the audible alarm that sounds when the Galaxy 65 Subsystem becomes too hot, detects low or high voltage, or an array becomes critical or offline. Changing the mute setting lets you turn off the alarm when it is sounding. You should turn it back on after resolving the problem.

You can also use the Mute button on the Galaxy 65 Ops Panel to turn off the alarm when it sounds.

The alarm sounds for temperature or voltage conditions (events). Warning events are generated when the temperature or voltage enters the warning range. Shutdown events are generated when the temperature or voltage enters the shutdown range. After reaching the shutdown range, the Galaxy 65 Subsystem will not function. You must resolve the problem and restart the Galaxy 65 Subsystem. If the problem is not resolved, it will shut down again.

Alarm conditions trigger an event message that displays in the Disk Array Administrator software window and in the event log. See D.5, ”Capturing the Event Log, Hardware, and Configuration Information”, on page 164.

A change to this setting on either SM module is automatically updated on the other SM module.

Table 7–3shows the temperature and voltage thresholds for each alarm and what to do to resolve the problem.

Table 7–3 .Alarm thresholds

Alarm threshold	What to do when the alarm sounds
Galaxy 65 internal temperature • Warning: 0°C to 4°C and 66°C to 70°C • Shutdown: <0°C and >70°C	• Check the Disk Array Administrator software to confirm what the alarm means. See D.2, "Displaying the Event Log", on page 154. • Check the ambient temperature and lower it, if needed. Ambient temperature should be less than 45°C. • Check that the Galaxy 65 Subsystem has good airflow clearance. The Galaxy 65 Subsystem requires airflow clearance on all sides, except the bottom and top. • Check that the internal fans are running. The fans are in the Power Managers.
Galaxy 65 CPU temperature • Warning: 0°C to 4°C and 91°C to 100°C • Shutdown: <0°C and >100°C	• Same as above.
VCC voltage • Warning: 5 V -10% to -8% and +8% to +10% • Shutdown: 5 V <-10% and >+10%	• Check the Disk Array Administrator software to confirm what the alarm means. See D.2, "Displaying the Event Log", on page 154. • If it is a warning alarm, let the Galaxy 65 Subsystem continue to operate. • If it is a shutdown alarm, see which SM module is showing the alarm. If only one SM module shows the alarm, replace that SM module. If it is both, you must troubleshoot the Power Supply/Cooling modules.

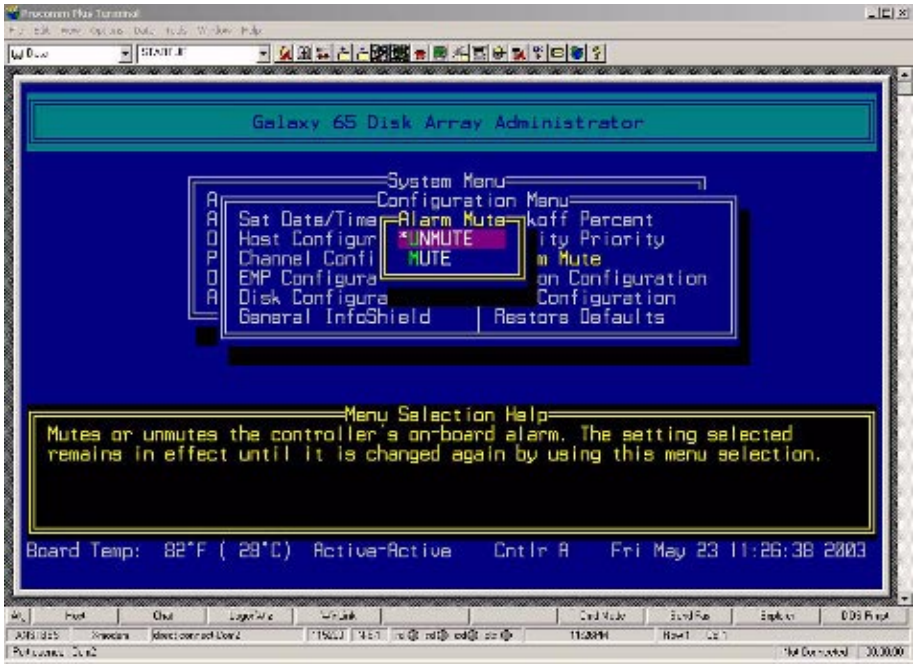
Table 7–3 .Alarm thresholds

Alarm threshold	What to do when the alarm sounds
12V voltage • Warning: 12 V -20% to -10% and +10% to +20% • Shutdown: 12 V <-20% and >+20%	• Same as above for the VCC voltage.
2.5 V voltage • Warning: 2.5 V -10% to -8% and +8% to +10% • Shutdown: N/A	• Same as above for the VCC voltage.

To enable or disable the alarm:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Alarm Mute** and press **Enter**
The Alarm Mute screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Alarm Mute
*UNMUTE
MUTE
Set Date/Time
Host Configur
Channel Confi
ENP Configura
Disk Configura
General InfoShield
Restore Defaults
Menu Selection Help
Mutes or unmutes the controller's on-board alarm. The setting selected remains in effect until it is changed again by using this menu selection.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:26:38 2003

3 Select the option you want and press **Enter**.

G.7 Locking the Cache Setting

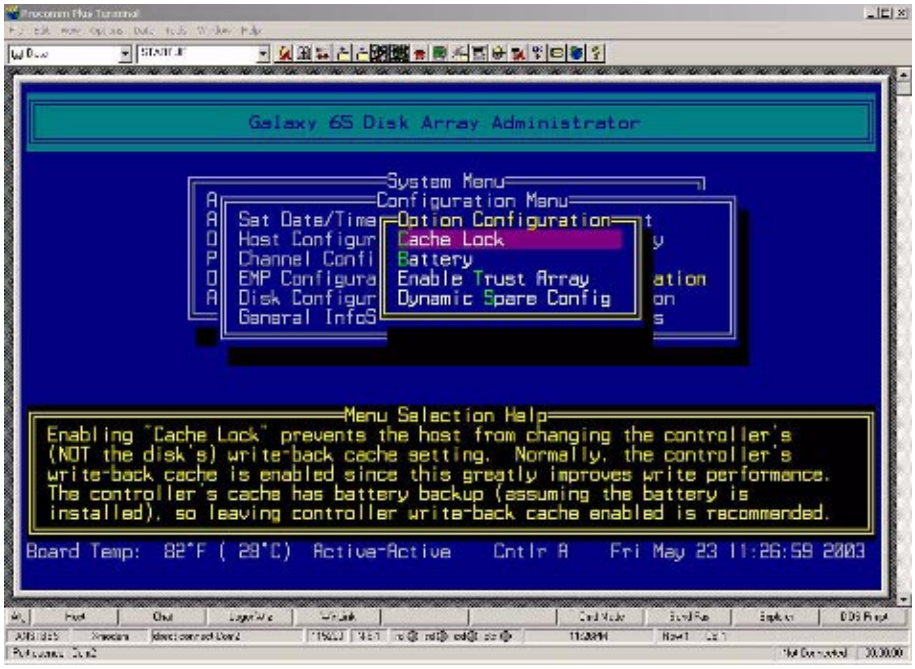
You can prevent host systems from using SCSI mode-select commands to change the Galaxy 65 Subsystem's write-back cache setting. Some operating systems disable write cache. If cache lock is enabled, the host cannot modify the cache setting. The default setting is disabled.

This option is useful in some environments where the host system disables the SM module's write-back cache, resulting in degraded performance. A change to this setting on either SM module is automatically updated on the other SM module.

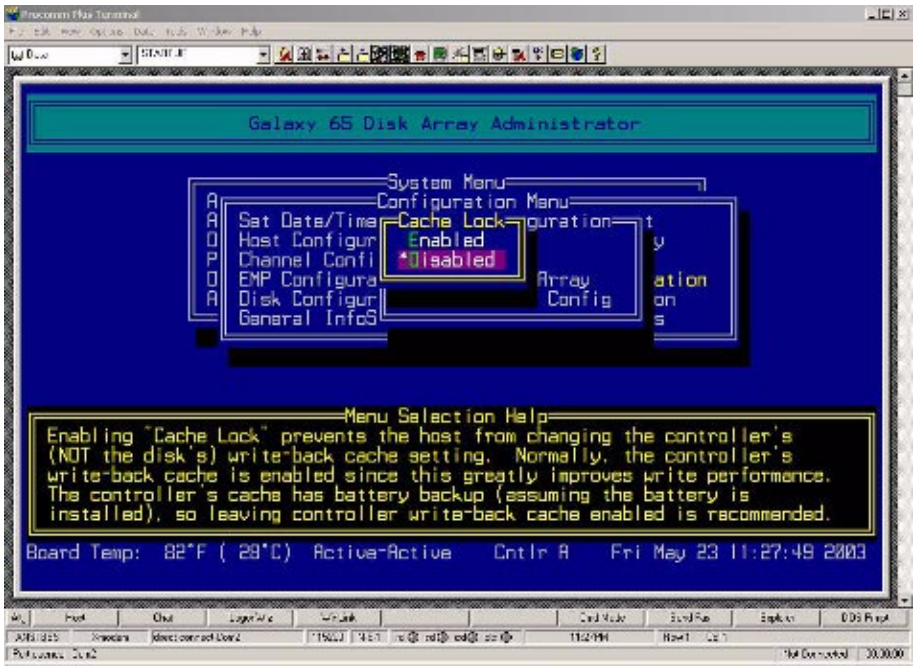
To lock the cache setting:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Option Configuration** and press **Enter**.
The Option Configuration screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Set Date/Time
Host Configur
Channel Confi
EMP Configura
Disk Configur
General Info
Option Configuration
Cache Lock
Battery
Enable Trust Array
Dynamic Spare Config
Menu Selection Help
Enabling "Cache Lock" prevents the host from changing the controller's
(NOT the disk's) write-back cache setting. Normally, the controller's
write-back cache is enabled since this greatly improves write performance.
The controller's cache has battery backup (assuming the battery is
installed), so leaving controller write-back cache enabled is recommended.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:26:59 2003

3 Select **Cache Lock** and press **Enter**.
The Cache Lock screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Set Date/Time
Host Configur
Channel Confi
EMP Configura
Disk Configur
General InfoS
Cache Lock
Enabled
*Disabled
Array Config
Menu Selection Help
Enabling "Cache Lock" prevents the host from changing the controller's (NOT the disk's) write-back cache setting. Normally, the controller's write-back cache is enabled since this greatly improves write performance. The controller's cache has battery backup (assuming the battery is installed), so leaving controller write-back cache enabled is recommended.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:27:49 2003

4 Select the option you want and press **Enter**.

G.8 Enabling and Disabling the Battery

If you are not using a battery in your Galaxy 65 Subsystem, the Galaxy 65 Subsystem will sound an alarm. To eliminate the alarm, you can disable the battery. The default setting is battery enabled.

Note You should only disable the battery if you are running the Galaxy 65 Subsystem with an Uninterruptible power supply (UPS), so that you will not lose power to the Galaxy 65 Subsystem.

If you disable the battery, the Galaxy 65 Subsystem will *not* give any warnings, nor will it disable the write-back cache.

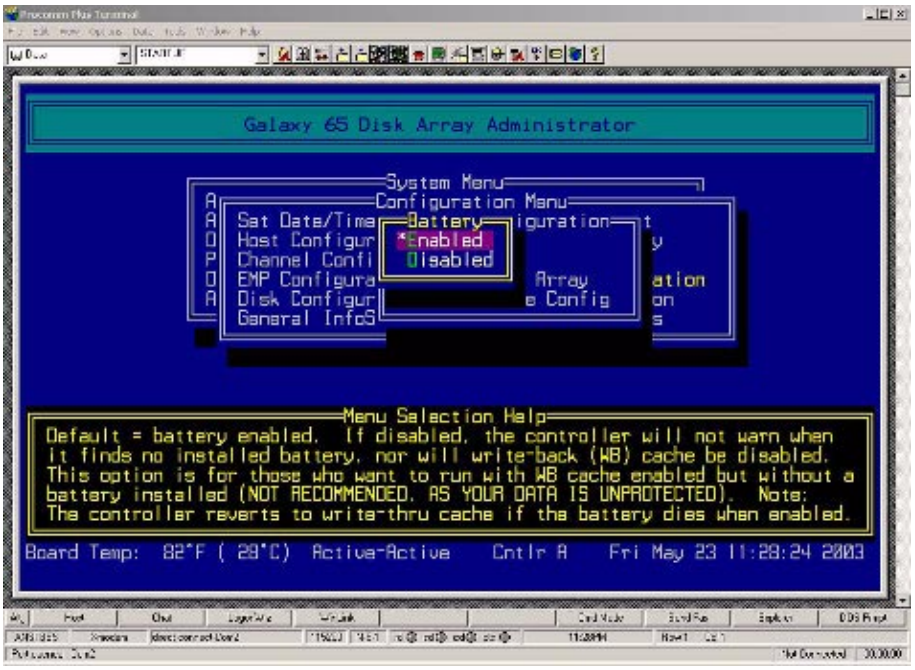
If you change this setting, you must restart the Galaxy 65 Subsystem for the change to take effect.

To change the battery setting:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Option Configuration** and press **Enter**.
The Option Configuration screen displays.

3 Select **Battery** and press **Enter**.
The Battery screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
Configuration Menu
Set Date/Time
Host Configur
Channel Confi
EMP Configura
Disk Configur
General InfoS
Battery
*Enabled
Disabled
Array
e Config
Menu Selection Help
Default = battery enabled. If disabled, the controller will not warn when it finds no installed battery, nor will write-back (WB) cache be disabled. This option is for those who want to run with WB cache enabled but without a battery installed (NOT RECOMMENDED, AS YOUR DATA IS UNPROTECTED). Note: The controller reverts to write-thru cache if the battery dies when enabled.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:28:24 2003

4 Select the option you want and press **Enter**.

5 Restart to have your changes take effect.

See G.1, ”Shutting Down and Restarting the Storage Manager Module”, on page 190.

G.9 Changing the Utility Priority

You can change the priority at which all utilities (Verify, Reconstruct, Expand, Initialize, etc.) run when there are active I/O operations competing for the Galaxy 65 Subsystem’s CPU. The choices are:

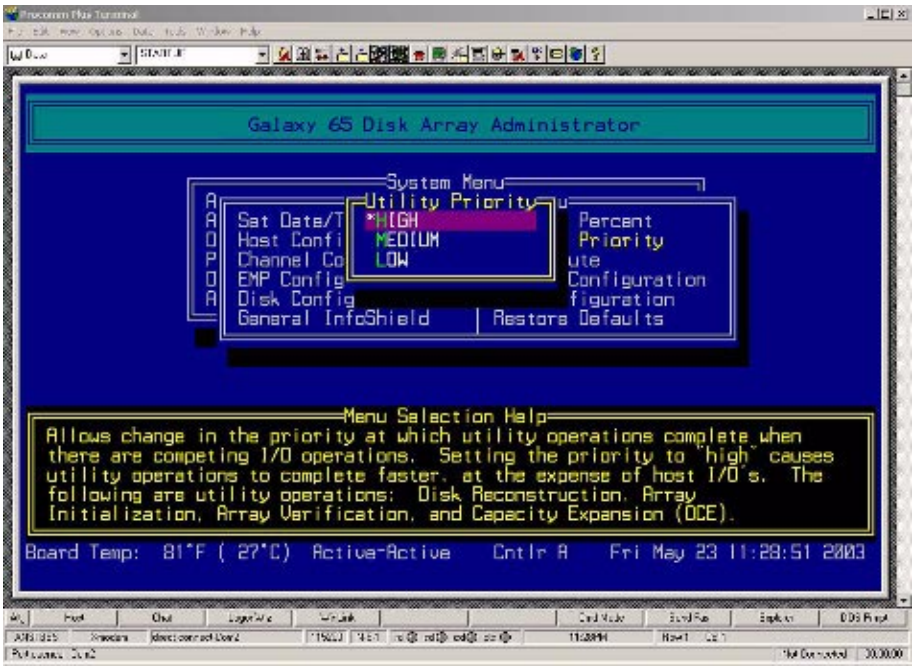
- High (default)
- Medium
- Low

For example, select High if your highest priority is to get the array back to a fully fault-tolerant state. This causes heavy I/O with the host to be slower than normal. Select Low priority if streaming data without interruption, such as for a Web server, is more important than data redundancy. This allows the Reconstruct or other utility to run at a slower rate with minimal effects on host I/O.

To change the utility priority:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Utility Priority** and press **Enter**.
The Utility Priority screen displays. The current setting is marked with an * next to it.


Galaxy 65 Disk Array Administrator
System Menu
Utility Priority
*HIGH
MEDIUM
LOW
Sat Date/T
Host Confi
Channel Co
EMP Config
Disk Config
General Info
Shield
Restore Defaults
Percent
Priority
ute
Configuration
figuration
Menu Selection Help
Allows change in the priority at which utility operations complete when there are competing I/O operations. Setting the priority to "high" causes utility operations to complete faster, at the expense of host I/O's. The following are utility operations: Disk Reconstruction, Array Initialization, Array Verification, and Capacity Expansion (OCE).
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 11:28:51 2003

3 Select the option you want and press **Enter**.

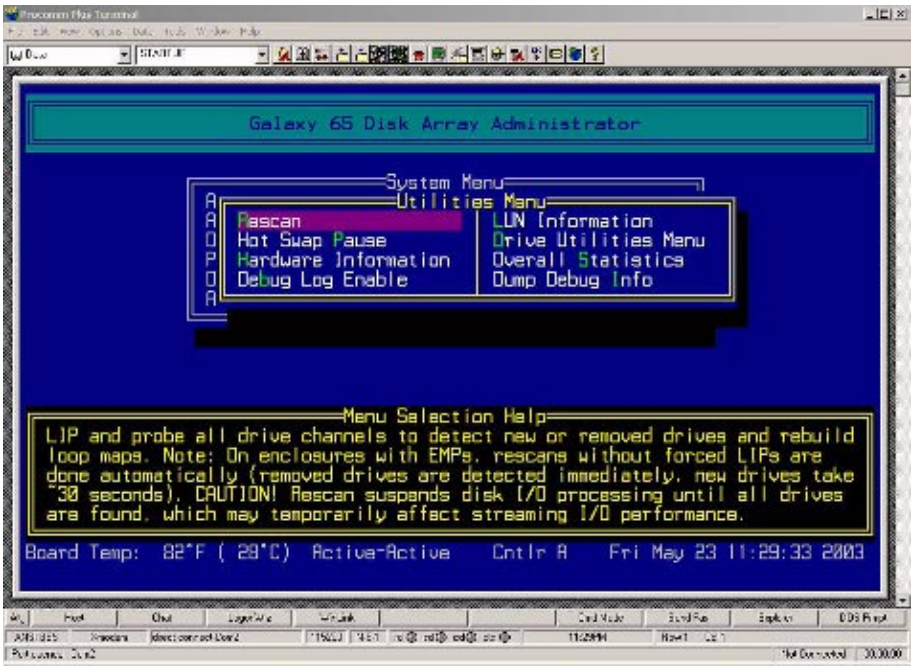
G.10 Rescanning All Channels

You can tell the Galaxy 65 Subsystem to scan all disk channels for new or removed disk drives. You can use this option when you install or remove drives. The rescan temporarily pauses all I/O processes and then resumes normal operation.

If you are using an enclosure with an EMP, the Galaxy 65 will perform a rescan automatically. With an EMP, the EMP detects the change in drive status and updates the Galaxy 65 about removed drives almost immediately; however, installed drives will be detected after a three-minute delay. This delay is to allow the new drives to spin up.

To rescan all channels:

1 From the System Menu, select **Utilities Menu** and press **Enter**.
The Utilities Menu displays.


Galaxy 65 Disk Array Administrator
System Menu
Utilities Menu
Rescan
Hot Swap Pause
Hardware Information
Debug Log Enable
LUN Information
Drive Utilities Menu
Overall Statistics
Dump Debug Info
Menu Selection Help
LIP and probe all drive channels to detect new or removed drives and rebuild loop maps. Note: On enclosures with EMPs, rescans without forced LIPs are done automatically (removed drives are detected immediately, new drives take ~30 seconds). CAUTION! Rescan suspends disk I/O processing until all drives are found, which may temporarily affect streaming I/O performance.
Board Temp: 82°F (28°C) Active-Active Cntlr A Fri May 23 11:29:33 2003

2 Select **Rescan** and press **Enter**.

G.11 Pausing I/O

Most drive enclosures allow you to remove and replace drives while FC disk channel activity continues. However, you may still want to pause I/O if you are replacing more than one disk drive. The Hot Swap Pause option suspends activity on all device channels used in the Galaxy 65 Subsystem, thereby ensuring data integrity on the connected drives and arrays.

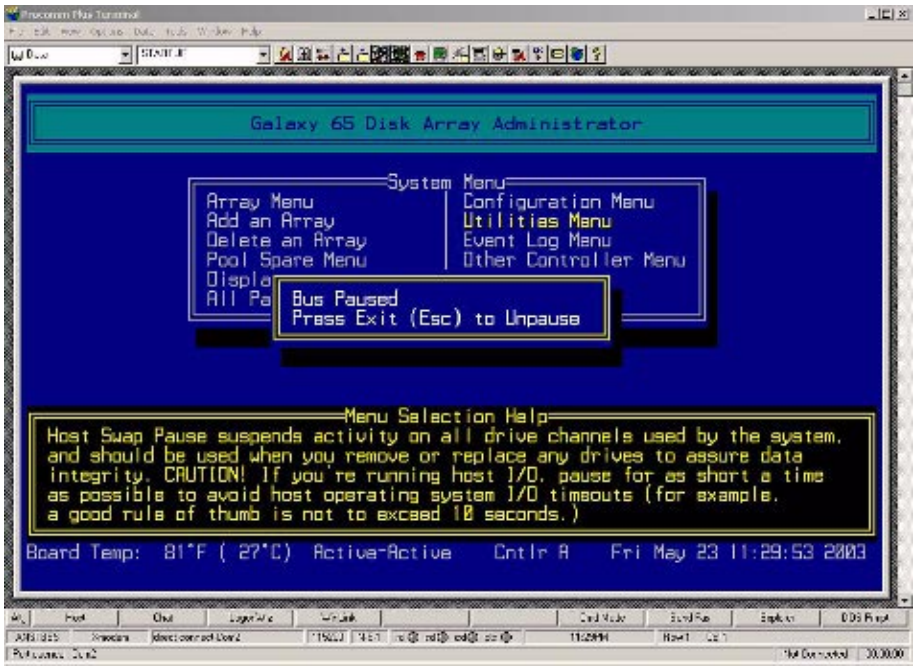
Caution *Pausing I/O halts active I/O to the host.*

Note If you are not sure that your enclosure supports hot swapping, use the Hot Swap Pause option before you remove or replace any drives in an array.

To pause I/O:

1 From the System Menu, select **Utilities Menu** and press **Enter**.
The Utilities Menu displays.

2 Select **Hot Swap Pause** and press **Enter**
The Bus Paused screen displays.


Galaxy 65 Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Bus Paused
Press Exit (Esc) to Unpause
Menu Selection Help
Host Swap Pause suspends activity on all drive channels used by the system, and should be used when you remove or replace any drives to assure data integrity. CAUTION! If you're running host I/O, pause for as short a time as possible to avoid host operating system I/O timeouts (for example, a good rule of thumb is not to exceed 10 seconds.)
Board Temp: 81°F (27°C) Active-Active Cntlr A Fri May 23 11:29:53 2003

3 When you have replaced the drive, resume back end activity by pressing **Esc**.

Caution *Do not stay in the Hot Swap Pause mode for too long; otherwise, an operating system time-out may occur (the time varies according to the operating system). For example, in Windows NT, the default limitation during I/O activity is 10 seconds.*

G.12 Restoring Default Settings

You can restore all of the Galaxy 65 Subsystem default settings. You may want to do this if the Galaxy 65 is not working properly and you cannot determine why. This lets you then change the settings that are critical to your configuration.

To restore the default settings:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **Restore Defaults** and press **Enter**.
The Restore Defaults screen displays.

The system confirms that you want to make the change.

3 Select **Yes** and press **Enter** to make the change.
The system confirms that the change is made.

4 Press **Enter** to return to the Configuration Menu.

G.13 Updating Firmware

You can update five types of firmware for each Galaxy 65 Subsystem:

- Storage Manager
- Storage Manager loader
- Memory controller
- LAN Subsystem
- LAN Subsystem loader

Information regarding the latest release of firmware and firmware updates is available from technical support.

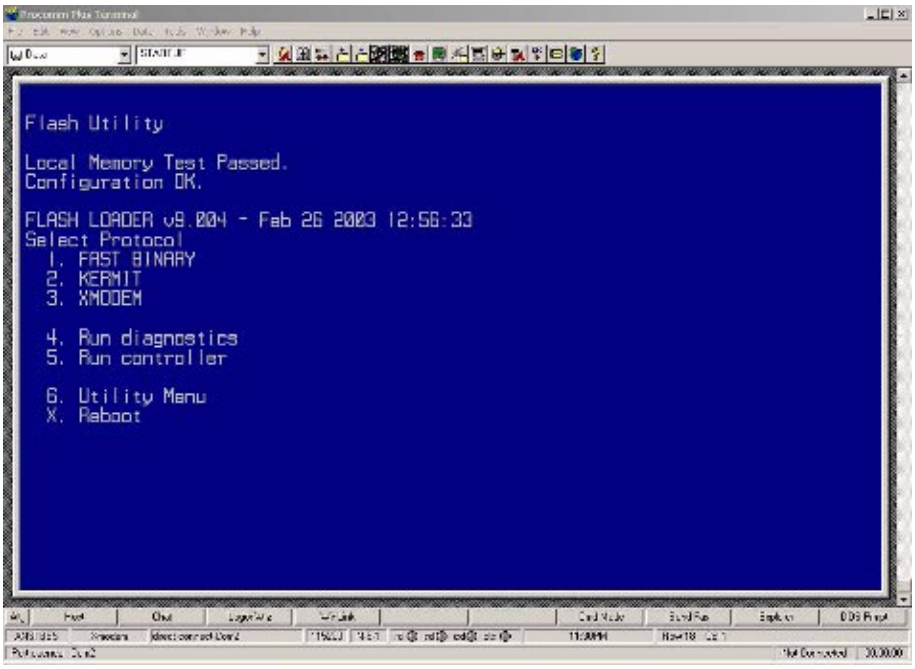
G.13.1 Updating the SM, SM Loader and Memory Controller Firmware

You use the Flash Utility to download new firmware (.fla file) for your SM modules, memory controller, and the storage controller loader. The Flash Utility is resident in the embedded firmware of the SM modules. You can access the Flash Utility using either your RS-232 or Ethernet connection to the SM module. If you want to use the Ethernet connection, your Telnet utility must support either the Kermit or Xmodem protocol.

Follow the procedure below for both SM modules to make sure that both have the updated firmware.

To upgrade the Storage Manager, Storage Manager Loader and Memory Controller firmware:

1. Call technical support for information about downloading the firmware updates.
2. From the computer connected to the SM module, access the Disk Array Administrator software.
3. From the System Menu, select **Shutdown Menu** and press **Enter**.
   The Shutdown Menu displays.
4. Select **Shutdown/Restart** and press **Enter**.
   The system confirms that you want to shut down.
5. Select **Yes** and press **Enter**.
   The system confirms that it has shut down.
6. Press **Enter** to restart.
7. While the SM module restarts, hold down the spacebar on your keyboard.
   The Flash Utility screen displays.



8 Press the number on your keyboard that corresponds to the protocol you want to use to transfer the firmware upgrade file from your computer to the SM module.

We recommend using the KERMIT protocol.

The system shows that it is ready to use KERMIT.

9 Using your terminal emulator software, send the.fla file using KERMIT.

If you are using HyperTerminal, select **Transfer > Send File**, navigate to where the firmware update file is located, select it, and click **Open**. Select the same Protocol from the drop-down list that you selected from the Flash Utility screen. Click **Send**.

The file transfers. The system displays messages showing that it is flashing the code and restarting the SM module.

Caution *Do not interrupt the power when transferring the new firmware.*

10 Repeat steps 2 through 9 on the other SM module.

G.13.2 Updating LAN Firmware

You can also update the firmware for the LAN Subsystem inside the SM modules and the LAN Subsystem loader. The firmware is contained in a.bfl file.

Updating the LAN firmware works best from a system that is *not* running Windows 95 or 98. When using Windows 95 or 98, you received a timeout message even though the ftp process is continuing. If you upgrade the LAN firmware from other operating systems, such as Windows NT or Windows 2000, you do not receive this message.

To upgrade the LAN Subsystem's firmware:

1. Check the version of LAN firmware you have now by pressing **CTRL-E** until the configuration information screen with that information displays.
2. Call technical support for information about downloading the firmware updates.
3. From the computer connected to the SM module, access the DOS window.
4. At the DOS prompt change to the directory where you downloaded the.bfl file.
5. Enter:

   ftp [SM module's IP address]
6. At the User prompt enter:

   flash
7. At the Password prompt enter:

   flash
8. At the FTP prompt enter:

   bin
9. At the FTP prompt enter:

   put [.bfl file name] flash

   If you are using Windows 95 or 98, you will see a timeout message (Connection closed by remote host), but the ftp process is continuing. You can ignore the timeout message. Wait a few minutes and check the firmware version.

   If you are using another operating systems, you will see the downloading progress displayed on the screen.
10. When you see the restarting message, wait 60 seconds.
11. Check the version of LAN firmware you have now to make sure the firmware update worked by pressing **CTRL-E** until the configuration information screen with that information displays.
12. Repeat steps 3 through 11 on the other SM module.

Appendix H

LAN Configuration

.Before you can access the Disk Array Administrator software using the Ethernet port, you must set up each SM module for TCP/IP. The following sections describe the TCP/IP setup.

A SM module that is part of a TCP/IP network requires three basic IP configuration elements: IP address, subnet mask, and default gateway IP address. The SM module's IP address must be unique to the network in which the SM module resides. If the SM module is part of a publicly routed network (that is, attached to the Internet), the address must be globally unique.

This appendix describes how to configure the TCP/IP settings for the first time starting from the factory-set defaults.

H.1 Configuring the SM for TCP/IP

Before you can access the Disk Array Administrator software using the Ethernet port, you must set the IP address and subnet mask for the SM module. The default IP address is 10.0.0.1. You can do this by one of the following ways:

- Setting up your computer with an IP address that is compatible with the SM module default of 10.0.0.1, such as 10.0.0.42.
- Using the serial connection to the SM module and setting the address. See H.2.1, "Configuring the IP Settings", on page 214.

H.2 Configuring the LAN Settings

You can configure several LAN settings for each SM using the Disk Array Administrator software:

- IP settings (see page 214)
- FTP settings (see page 215)
- Telnet settings (see page 215)
- SNMP settings (see page 216)
- Contact settings (see page 217)
- HTTP settings (see page 218)
- Security options (see page 218)
- Reset LAN Subsystem (see page 219)

H.2.1 Configuring the IP Settings

You can set three IP-related settings:

- **IP Address**: Internet Protocol address of the SM module. Factory default is 10.0.0.1. You need two IP addresses, one for each SM module.
- **IP Mask**: Subnet mask. Factory default is 255.255.255.0.
- **Gateway**: Optional Factory default is 0.0.0.0. See your LAN administrator for more information.

If you are not sure what IP address, subnet mask, and gateway to use, contact your LAN administrator.

Record the IP addresses, IP mask, and gateway below:

- IP address for SM module A _____
- IP address for SM module B _____
- IP mask _____
- Gateway _____

To set the IP address, subnet mask, or gateway:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **LAN Configuration** and press **Enter**.
The LAN Configuration screen displays.

3 Select **IP Settings** and press **Enter**.
The IP Settings screen displays.

4 Select the option you want and press **Enter**.
The screen displays related to the option you selected.

5 Enter the IP address, subnet mask, or gateway you want and press **Enter**.
The system confirms that you want to make the change.

6 Select **Yes** and press **Enter**.
The system makes the change.

H.2.2 Configuring the FTP Settings

You can set two FTP-related settings:

- **Login**: Login name for FTP access to the SM module. You can use FTP to download firmware updates. You can enter up to 15 characters. The default is flash.
- **Password**: Password for FTP access to the SM module. You can enter up to 15 characters. The default is flash.

Changes to either of these settings on either SM module are automatically updated on the other SM module.

To set the FTP settings:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **LAN Configuration** and press **Enter**.
The LAN Configuration screen displays.

3 Select **FTP Settings** and press **Enter**.
The FTP Settings screen displays.

4 Select the option you want and press **Enter**.
The screen displays related to the option you selected.

5 Enter or select the option you want and press **Enter**.
The system confirms that you want to make the change.

6 Select **Yes** and press **Enter**.
The system makes the change.

H.2.3 Configuring the Telnet Settings

You can set two Telnet-related settings:

- **Password**: Password for accessing the SM module using the Ethernet port and Telnet. You can enter up to 32 characters. The default is null (press **Enter**).
- **Timeout**: Number of idle minutes before the Telnet session times out. The default is no timeout, which is shown as 0 minutes in the Disk Array Administrator.

Changes to either of these settings on either SM module are automatically updated on the other SM module.

To set the Telnet settings:

1. From the System Menu, select **Configuration Menu** and press **Enter**.
   The Configuration Menu displays.
2. Select **LAN Configuration** and press **Enter**.
   The LAN Configuration screen displays.
3. Select **Telnet Settings** and press **Enter**.
   The Telnet Settings screen displays.
4. Select the option you want and press **Enter**.
   The screen displays related to the option you selected.
5. Enter or select the option you want and press **Enter**.
   The system confirms that you want to make the change.
6. Select **Yes** and press **Enter**.
   The system makes the change.

H.2.4 Configuring the SNMP Settings

You can set six Simple Network Management Protocol (SNMP)-related settings:

- **Trap Host**: Host computer's IP address that is set up to receive SNMP traps. The default is 0.0.0.0.
- **Traps Enable**: On or off toggle to enable SNMP traps. The default is No (disabled).
- **Read Community**: SNMP read password. The default is Public.
- **Write Community**: SNMP write password. The default is Private.
- **Event Filter**: Informational, Warning, or Error. The default is Warning.
- **Trap Filte**r: Informational, Warning, or Error. The default is Warning.

Changes to any of these settings on either SM module are automatically updated on the other SM module.

To set the SNMP settings:

1. From the System Menu, select **Configuration Menu** and press **Enter**.
   The Configuration Menu displays.
2. Select **LAN Configuration** and press **Enter**.
   The LAN Configuration screen displays.

3 Select **SNMP Settings** and press **Enter**.
The SNMP Settings screen displays.

4 Select the option you want and press **Enter**.
The screen displays related to the option you selected.

5 Enter or select the option you want and press **Enter**.
The system confirms that you want to make the change.

6 Select **Yes** and press **Enter**.
The system makes the change.

H.2.5 Configuring the Contact Settings

You can set four contact settings:

- **System Name**: Name of the Galaxy 65 Subsystem as seen by other systems on the LAN. You can enter up to 80 characters. The default is Uninitialized Name.
- **System Contact**: Name of a contact person responsible for the Galaxy 65 Subsystem. You can enter up to 80 characters.
- **System Location**: Location of the Galaxy 65 Subsystem. You can enter up to 32 characters.
- **System Information**: Read-only screen with information about the system.

Changes to any of these settings on either SM module are automatically updated on the other SM module.

To set the contact settings:

1 From the System Menu, select **Configuration Menu** and press **Enter**.
The Configuration Menu displays.

2 Select **LAN Configuration** and press **Enter**.
The LAN Configuration screen displays.

3 Select **Contact Settings** and press **Enter**.
The Contact Settings screen displays.

4 Select the option you want and press **Enter**.
The screen displays related to the option you selected.

5 Enter or select the option you want and press **Enter**.
The system confirms that you want to make the change.

6 Select **Yes** and press **Enter**.
The system makes the change.

H.2.6 Configuring the HTTP Settings

You can set up the passwords for SAM, the browser-based interface. In SAM, you can set up two types of SAM users:

- **Monitor**: Have access to only the **Monitor** menu that lets you view the status and statistics pages. If you have logged in using a monitor password and select a page from the **Manage Galaxy 65** menu, SAM displays the Login page, where you can log in with the manage password. SAM then takes you to the page you requested. Three monitor users can be logged in at a time to each SM module.

- **Manage**: Have access to all SAM functions. Only one such user can be logged in at a time to each SM module.

Note SAM permits one manage user to log in to each SM module at the same time. If two users log in this way, their configuration changes could conflict.

To set the HTTP settings:

1. From the System Menu, select **Configuration Menu** and press **Enter**.
   The Configuration Menu displays.

2. Select **LAN Configuration** and press **Enter**.
   The LAN Configuration screen displays.

3. Select **HTTP Settings** and press **Enter**.
   The HTTP Settings screen displays.

4. Select the password you want to change and press **Enter**.
   The screen displays related to the password you selected.

5. Enter the new password you want and press **Enter**

   You can enter up to 15 characters for each password. You can only use letters, numbers, and underscores.

   The system confirms that you want to make the change.

6. Select **Yes** and press **Enter**.
   The system makes the change.

H.2.7 Configuring the Security Options

You can enable or disable the following LAN-related functions:

- **Telnet**: Controls access to the SM modules using Telnet, which permits you to manage the Galaxy 65s using your LAN. The default is enabled.

- **FTP**: Controls access to the SM modules using file transfer protocol (FTP), which permits you to upgrade the SM module’s LAN Subsystem firmware. The default is enabled.

- **HTTP**: Controls access to the SM modules using hypertext transfer protocol (HTTP), which permits you to manage the SM modules using SAM. The default is enabled.
- **SNMP**: Controls the availability of SNMP, which permits remote monitoring of the Galaxy 65 using your LAN. The default is enabled.
- **Internet Debug**: Used for diagnosing problems during the technical support process. We recommend that this remain disabled unless support personnel tell you to enable it. The default is disabled.

Changes to any of these settings on either SM module are automatically updated on the other SM module.

To change any of the security options:

1. From the System Menu, select **Configuration Menu** and press **Enter**.
   The Configuration Menu displays.
2. Select **LAN Configuration** and press **Enter**.
   The LAN Configuration screen displays.
3. Select **Security Options** and press **Enter**.
   The Security Options screen displays.
4. Select the option you want and press **Enter**.
   The screen displays related to the option you selected. The current option has an * next to it.
5. Select **Enable** or **Disable** and press **Enter**.
   The system makes the change.

H.2.8 Resetting the LAN Subsystem

If you are having difficulty communicating with the SM module using the Ethernet connection, you can reset the LAN Subsystem in the SM module.

To reset the LAN Subsystem:

1. From the System Menu, select **Shutdown Menu** and press **Enter**.
   The Shutdown Menu displays.
2. Select **Reset LAN Subsystem** and press **Enter**
   The system confirms that you want to reset the LAN Subsystem.
3. Select **Yes** and press **Enter**.
   The system resets the LAN Subsystem.

Glossary

In glossary definition*s, italics* are used for items defined elsewhere in the glossary and **bold** is used for the items shown in brackets after the main heading of the entry.

address An address is a data structure or logical convention used to identify a unique entity, such as a particular process or network device.

arbitrated loop physical address (AL_PA) An AL_PA is a 1-byte value used in an arbitrated loop topology. This value is used to identify L_Ports. The value then becomes the last byte of the address identifier for each public L_Port on the loop.

ASCII American Standard Code for Information Interchange. A 7-bit binary code (0's, 1's) used to represent letters, numbers, and special characters such as $,!, and /. Supported by almost every computer and terminal manufacturer.

Attribute Setting that controls access to a specific file. Often used to protect important files (such as the Registry files) from accidental change or deletion. Set using the ATTRIB command in MS-DOS.

Backplane A printed circuit board incorporated in the chassis assembly to provide logic level signal, and low voltage power distribution paths.

Bay The slot that a unit or media device fits into.

Bifurcated (power cord) Throughout this user guide, the term is used as the UK equivalent of the US term furcated.

A bifurcated power cord is a two branched cord joined together by a yoke

bus See channel.

Byte A group of binary digits stored and operated upon as a unit. A byte may have a coded value equal to a character in the ASCII code (letters, numbers), or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters.
1 kilobyte (K) is equal to 1,024 bytes or characters; 64K indicates 65,536 bytes or characters.

Cable Throughout this Galaxy 65 user guide this term is used in accordance with the preferred US context of: “an insulated flexible electric wire used for the transmission of data signals between computer equipment.”
Note: Cable is UK preferred terminology for either a power cord or a data cable:

channel A channel is a common physical path composed of wires or other media, across which signals are sent from one part of a computer to another. A channel is a means of transferring data between modules and adapters, or between an adapter and SCSI or Fibre Channel devices. A channel topology network consists of a single cable trunk that connects one workstation to the next in a daisy-chain configuration. All nodes share the same medium, and only one node can broadcast messages at a time.

Character A representation, coded in binary digits, of a letter, number, or other symbol.

Characters Per Second A data transfer rate generally estimated from the bit rate and the character length. For example, at 2400 bps, 8-bit characters with Start and Stop bits (for a total of ten bits per character) will be transmitted at a rate of approximately 240 characters per second (cps).

Chassis A sheet metal enclosure incorporating a Backplane PCB and module runner system. The chassis contains a number of 'Bays', each of which can accommodate a plug in module. There are sixteen *drive* carrier bays at the front and five bays at the rear which house *power supply/cooling* and LRC *I/O modules* and also the *Ops Panel*.

Configure To set up a hardware device and its accompanying software.

controller "A" In a redundant controller environment, one controller is designated as controller "A" and the other controller is designated as the controller "B". Controller identity is determined by enclosure hardware. The controller's identity displays continuously at the bottom of the Disk Array Administrator screens. See *Storage Manager.*

Data Communications A type of communications in which computers and terminals are able to exchange data over an electronic medium.

Disk (drive, carrier, module) A FC-Galaxy 65 FC-AL disk **drive** mounted in a **carrier**. You can have up to sixteen disk ***drive carrier*** *modules* in each Galaxy 65 enclosure.

Enclosure The chassis assembly which houses the plug-in modules that make up the Galaxy 65 storage Subsystem.

ESI/Ops module A unit used to monitor and control all elements of the Enclosure. The **ESI/Operators (Ops)** panel is supplied as an integral part of the Galaxy 65 series Enclosure core product

fabric Fabric refers to a switched topology, which is one of the three FC topologies. Fabric elements, which are responsible for frame routing, interconnect various N_Ports or NL_Ports. Connections to fabric can use loop (public loop) or point to point.

failback In Active-Active mode, failback is the act of returning ownership of controller resources from a surviving controller to a previously failed (but now active) controller. The resources include disk arrays, cache data, and host ID information.

failover In Active-Active mode, failover is the act of temporarily transferring ownership of controller resources from a failed controller to a surviving controller. The resources include disk arrays, cache data, and host ID information.

FC adapter An FC adapter is a printed circuit assembly that translates data between the FC host processor's internal bus and FC link.

FC Arbitrated Loop (FC-AL) FC-AL is one of three FC topologies in which ports use arbitration to establish a point-to-point circuit. Arbitrated loops allow multiple ports to be connected serially in a single loop. Up to 126 NL_Ports and 1 FL_Port can be configured in a unidirectional loop. Ports arbitrate for access to the loop based on their AL_PA. Ports with lower AL_PAs have higher priority than ports with higher AL_PAs. FC-AL can be public, typically connected using switched fabric, or private, typically a direct host connection or hub.

FC device A device that uses FC communications is referred to as an FC device.

FC port An FC port is the opening at the back of a router that provides a fiber optic connection between the FC adapter and FC host.

FC protocol for SCSI (FCP) FCP defines an FC mapping layer (FC-4) that uses FC-PH services to transmit SCSI command, data, and status information between a SCSI initiator and SCSI target. FCP enables transmission and receipt of SCSI commands, data, and status across the FC using standard FC frame and sequence formats.

Fibre Fibre is a generic FC term that refers to all transmission media types specified in the FC Physical Layer standard (FC-PH), such as optical fiber, copper twisted pair, and copper coaxial cable.

Fibre Channel (FC) FC is a bidirectional, point-to-point serial data channel, structured for high-performance capability. In the physical sense, an FC is an interconnection of multiple communication points, called N_Ports, by a switching network (fabric). FC transports incoming data from devices by reading the buffer information, packaging it, and sending the information across the fabric. Although FC is a generalized transport mechanism that has no protocol of its own or native I/O command set, it can transport any existing upper-level protocol such as SCSI and IP. FC offers high-speed data transfer rates. FC is most commonly used to connect clustered servers to storage systems. ANSI has developed standards for FC.

gigabit interface converter (GBIC) A GBIC, also referred to as a Physical Link Module, is a physical component that manages functions of the FC-0 layer. This layer consists of the physical characteristics of the media and interface, including drivers, transceivers, connectors, and cables. A GBIC attaches to an FC adapter and connects a router to an FC host.

high voltage differential (HVD) HVD is a differential SCSI scheme with terminators that run on 5 volts.

host bus adapter (HBA) An HBA is the critical link between a host server or workstation and a storage Subsystem, integrating computing platforms, operating systems, and I/O protocols to ensure proper inter operability and functionality. The bus adapter provides direct storage connectivity from the system to data within the storage Subsystem and enables stable, high-speed transmission of information and files. HBAs manage the controller-specific aspects of handling a storage driver interface device implemented as a target driver, which supports mass storage peripheral devices such as disks and tapes. A storage driver interface is used to implement SCSI and other storage device drivers. An HBA connects to the storage Subsystem to the host computer and uses either fiber or copper media.

Hot plugging A device with the capability of being connected to a Subsystem without interrupting the power supplies to that Subsystem.

Hot swap Hot swapping is the term used for manually swapping a failed disk unit with a replacement while the Galaxy 65 Subsystem is in normal use.

Hz (Hertz) a frequency measurement unit used internationally to indicate cycles per second.

in-band Method of accessing and managing the SM controller or Galaxy 65 Subsystem using the SCSI or FC host connection. This type of access is available using CAPI to develop a programmed interface.

Initialize To prepare a hardware device for use.

initiator An initiator is an FC or SCSI device that contains application clients that originate service requests and task management functions for processing by a target FC or SCSI device.

initiator mode Initiator mode is the configuration mode of a device in which an FC or SCSI initiator requests operations to be performed by an FC or SCSI target device.

kill In Active-Active mode, one controller can kill the other controller by resetting it and taking it offline.

LED Light Emitting Diode. A small light displayed on the cabinet, disk units and power supply units.

logical unit number or logical unit (LUN) A LUN is a subdivision of a SCSI target. For SCSI-3, each SCSI target supports up to 128 LUNs. An FC host using LUNs can address multiple peripheral devices that may share a common controller.

loop address Loop address is an FC term that indicates the unique ID of a node in FC loop topology. A loop address is sometimes referred to as a Loop ID.

Loop Resiliency Circuit (LRC): Circuits within the *SM modules* which provide loop resiliency in the event of a drive failing or being unplugged.

low voltage differential (LVD) LVD is a method of powering SCSI cables that will be formalized in the SCSI-3 specifications. LVD uses less power than the current differential drive (HVD), is less expensive, and allows for higher speeds such as those of Ultra2 SCSI. LVD requires 3.3 volts (versus 5 volts for HVD).

LRC I/O module A plug-in Input/Output module used to connect the internal FC--AL channels from the Galaxy 65 backplane to the rear of the enclosure.

management information base (MIB) A MIB is a database of managed objects accessed by network management protocols. An SNMP MIB is a set of parameters that an SNMP management station can query or set in the SNMP agent of a network device (for example, a router).

mapping table A mapping table is a table indexed by sequential LUN values. The values indicate select bus:target:LUN devices. Mapping tables are used by some routers to perform FC-to-SCSI operations by default.

Module (drive carrier, power supply/cooling, storage manager) A module is a power supply, disk drive or electronics unit held in a carrier that plugs into a bay inside the enclosure. A Galaxy 65 enclosure can contain sixteen ***drive carrier*** *module*s, two ***power supply/cooling modules*** and two ***Storage Manager*** *module*s.

Operating system The software running the host computer. For example, on PCs it is often Windows 95/98, Windows NT or OS/2 and on Hewlett-Packard machines it could be HP-UX.

other controller or SM The opposite controller or Storage Module (SM) from the one currently being used (that is, not the local controller or SM that you are connected to) is referred to as the other.

out-of-band Method of accessing and managing the Rorke Data controller or Subsystem using the RS-232 or Ethernet, if available, connection.

ownership In an active-active configuration, a single controller has ownership of the following resources: arrays and dedicated spares. When a controller fails, the other controller assumes temporary ownership of its resources

Parallel Transmission The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. See *Serial Transmission*.

partition A partition is a logical subdivision of an array to which you can assign a LUN. You can add, expand, rename, change the LUN, and delete partitions using the RAID controller's software. This type of partition is not the same as a partition you create with your operating system or third party tools.

point to point A point-to-point connection is a dedicated communication link between two devices as an alternative to FC-AL. Rorke Data uses this term to refer to a link between the controller or router (N-port) and the F-port on a switch. Rorke Data supports point-to-point connections to fabric ports only (sometime referred to as F-ports).

Power Cord Throughout this Galaxy 65 user guide this term is used in accordance with the preferred US context of: "an insulated flexible electric wire fitted with connectors at each end and used for the transmission of electrical power to computer equipment.

Power Supply/Cooling module One module in the Galaxy 65 Subsystem family of RAID products. Power Supply/Cooling modules contain the power supply and two cooling fans.

Protocol A system of rules and procedures governing communications between two or more devices. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error correction are some of the operations that may be defined in protocols.

Redundant Not essential.

router A router is a device that enables connectivity between SCSI devices and FC networks. It routes each data command to the appropriate SCSI channel based on the address it is intended for.

SAM (Storage Array Manager): For the Galaxy 65 Subsystem family of RAID products, provides a browser-based interface for configuring, managing, and monitoring the Galaxy 65 Subsystem. In both the user interface and the documentation, it is often referred to as SAM.

SCSI adapter A SCSI adapter is a 16-bit fast/wide or 8-bit narrow, single-ended or differential physical connection between a router and SCSI devices. Each SCSI adapter supports up to 16 (fast/wide) or 8 (narrow) SCSI devices, including itself.

SCSI addressing Each device supported by a SCSI adapter has its own unique SCSI address, which dictates the device's priority when arbitrating for access to the SCSI bus. A SCSI address of 7 has the highest priority. For a fast/wide SCSI adapter that supports up to 16 devices, the next highest priority address is 6, then 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8. A narrow SCSI adapter supports up to eight devices, including itself. The SCSI address 7 has the highest priority, followed by 6, 5, 4, 3, 2, 1, and 0.

SCSI bus A SCSI bus provides a means of transferring data between SCSI devices. A SCSI bus is either an 8- or 16-bit bus that supports up to 8 or 16 devices, including itself. The bus can consist of any mix of initiators and targets, with the requirement that at least one initiator and one target must be present.

SCSI device A SCSI device is a single unit on a SCSI bus that originates or services SCSI commands. A SCSI device is identified by a unique SCSI address. SCSI devices can act as initiators or targets.

SCSI port A SCSI port is an opening at the back of a router that provides connection between the SCSI adapter and SCSI bus.

Serial Transmission The transfer of data characters one bit at a time, sequentially, using a single electrical path. See *Parallel Transmissio*n.

Simple Network Management Protocol (SNMP) SNMP is the Internet standard protocol, defined in STD 15, RFC 1157, developed to manage nodes on an Internet Protocol (IP) network.

small computer system interface (SCSI) SCSI is an industry standard for connecting peripheral devices and their controllers to an initiator. Storage devices are daisy-chained together and connected to a host adapter. The host adapter provides a shared bus that attached peripherals use to pass data to and from the host system. Examples of devices attached to the adapter include disk drives, CD-ROM discs, optical disks, and tape drives. In theory, any SCSI device can be plugged into any SCSI controller.

small form-factor pluggable (SFP) Type of connector.

speed Speed shows the speed of the FC port interface.

Storage Area Network (SAN) SAN refers to the network behind servers that links one or more servers to one or more storage systems. Each storage system could be RAID, tape backup, tape library, CD-ROM library, or JBOD. SANs operate with both SCSI and networking (IP) protocols. Servers and workstations use the FC network for shared access to the same storage device or system. Legacy SCSI systems are interfaced using an FC-to-SCSI bridge.

Storage Manager module The controller module which includes an FC-AL 2Gb/s *LRC I/O module* with integral Rorke Data Galaxy 65 RAID controller.

target A target is a device (peripheral) that responds to an operation requested by an initiator (host system). Although peripherals are generally targets, a peripheral may be required to act temporarily as an initiator for some commands (for example, SCSI EXTENDED COPY command).

terminator block/termination A terminator block (or termination) refers to the electrical connection at each end of a SCSI bus. The terminator block is composed of a set of resistors, or possibly other components. The function of a terminator block is to provide a pull-up for open collector drivers on the bus, and also impedance matching to prevent signal reflections at the ends of the cable. SCSI buses require that a terminator be placed on the 68-pin high-density SCSI connector on the last SCSI peripheral. Data errors may occur in a SCSI bus that is not terminated.

topology A network topology refers to the physical layout of nodes on a network. Topologies range from local network topologies to WAN topologies. FC topologies include point-to-point, FC-AL, and fabric.

trap In the context of SNMP, a trap is an unsolicited message sent by an agent to a management station. The purpose is to notify the management station of some unusual event.

unkill In Active-Active mode, when a surviving controller removes the reset from the other controller, it unkills it. The other controller will reboot and attempt to come online.

write-back cache Memory on the controller that stores data changes until they are written to the disk drives. In most applications, using the controller's write-back cache improves performance and ensures data integrity. Disk drives also have write-back cache, which should be disabled for most applications.

Any disk drives with write-back cache enabled should be connected to an Uninterruptible power supply (UPS) in case of a power failure. If the drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk’s write-back cache.

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